











INTERNATIONAL INSTITUTE OF AGRICULTURE  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.  
ORIGINAL ARTICLES

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**Root-Nodosities of Crosses between Swedes and Turnips**

by

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The Danish Experimental Organization for Crops (1) has undertaken fairly exhaustive researches on crosses between swedes and turnips and the nodosities occurring on their roots. A short account of the information obtained may well be of general interest.

As is well known, swedes are derived from rape (*Brassica Napus*) and turnips from *Brassica campestris* (2). No nodosities form on the roots of crosses between two *Napus*-forms or two *campestris*-forms, but they occur when a *Napus*-form is crossed with a *campestris*-form, whichever be the female parent. If, for instance, the Bullock turnip is crossed with the Shepherd swede the offspring bear nodosities on their roots; but when Bullock is crossed with a summer *campestris*-rape or Shepherd with a summer *Napus*-rape, no such formations occur, although Bullock and Shepherd are much more like than *campestris*-rape and *Napus* rape. Both Bullock and Shepherd have round, thick, yellow-fleshed, green-topped roots; they are biennials with orange-yellow flowers. The two kinds of summer rape both have forked, woody and not fleshy, white roots, and are annuals with lemon-yellow flowers. Anyone not specially acquainted with the subject would be much more likely to expect root nodosities when such dissimilar plants as Bullock and *campestris*-rape or Shepherd and *Napus*-rape were crossed than when Bullock was crossed with Shepherd.

Notwithstanding the outward similarity of Bullock and Shepherd, there must be a decided inner difference between them, to judge by the antithesis exhibited in their sexual union; they show this by the appearance

(1) See article: « Organization of Field Experiments in Denmark, » by H. C. LARSEN, B. Oct. 1913, pp. 1479-1483. (Ed.).

(2) There seems to be no English name to distinguish the *campestris*-rape (rübсен) from the *Napus*-rape (rape), so that the Latin names will be used here. (Ed.).

of the monstrous growths which we call "nodosities due to crossing" (Kreuzungsknoten).

The nodosities are of various forms according as the hybrid in question is rape-like, swede-like or turnip-like; they therefore merit separate description.

1) In the *rape-like hybrids* the nodosities are quite small, but are so closely crowded along the branches of the roots that they appear almost as swellings with small transverse wrinkles and folds reaching the whole length of the root (see Fig. 1). Occasionally hemispherical nodosities occur; these have the flat face towards the fork of the root (see Fig. 1, right). In rape-like hybrids the swellings predominate, nodosities, when present, being of secondary importance.

2) The *swede-like hybrids* are characterised by the size and abundance of the nodosities and the slight development of swellings. The nodosities occur on the bulb and on the fibrous roots, and vary from the size of hen's eggs to that of peas (Fig. 2, A); exceptionally, they may reach 4 to 6 in. in diameter (Fig. 2, B), and even form clusters, thus giving the bulb a more or less misshapen appearance (Fig. 2, C). The nodosities of these swede-like hybrids differ from those of the rape-like and turnip-like hybrids in being sharply defined and generally only joined to the bulb (Fig. 2, B) or the root-let (Fig. 2, A) by small areas of union. The surface of the nodosities is very much wrinkled and uneven, something like the top of a cauliflower.

The rule mentioned above, that in swede-like hybrids nodosities are more abundant and swellings less so than in rape-like hybrids, is not true under all circumstances. The opposite is especially liable to occur in swede-like hybrids when the bulbs are unable to develop owing to the plants growing too thickly, to very late sowing or to other similar causes. Thus, when conditions prevent the formation of the bulb, the swede-like hybrid resembles the rape-like one (Fig. 1) in its root-characters.

3) In *turnip-like hybrids* the nodosities generally appear as characteristic tumour-like bunches on the bulb itself (cf. Fig. 3, D, and Fig. 4, B and A) and are attached to it by large surfaces; they never occur on the fibrous roots. They are not wrinkled like those of the rape-like and turnip-like hybrids, but quite smooth and sometimes shining (Fig. 3, A and B).

As is shown in Fig. 3, A, large clusters of nodosities may occur in turnip-like as in swede-like hybrids (cf. Fig. 2, C). It will also be noted that the turnip-like hybrids are not behind the swede-like ones as regards the size of the nodosities; but they may be quite small as in Fig. 3, C, in which the bulb might pass for a typical Yellow Tankard but for the small nodosity on the middle of the left side.

The swellings at the places where the roots branch are even more characteristic in turnip-like than in rape-like hybrids, but are by no means so abundant. The roots on which they occur are disproportionately thickened throughout their whole length (see Fig. 4, C); as in the rape-like hybrids these swollen parts are transversely furrowed. Sometimes these swollen side-roots are double (Fig. 4, C), apparently owing to the union of two root-lets throughout their length.

Among the turnip-like hybrids it is not uncommon to find plants like in Fig. 4, in which the bulb has hardly developed at all, but is replaced by a number of short, much-swollen side roots.

Further attention should be drawn to the fact that turnip-like hybrids never produce a feature occasionally seen in the other two types, namely the occurrence of a certain number of adventitious shoots bearing rudimentary leaves arising from on or among the nodosities (see Fig. 5 and Fig. 2, D). Such shoots remain below ground and are consequently chlorotic throughout, unless they arise from roots at a very slight depth, when they may project to a maximum of 4 or 5 inches and become green.

As these nodosities occurring on hybrid swedes and turnips are liable to confusion with those caused by the finger-and-toe organism (*Plasmiodiophora Brassicae*), it may be well to describe briefly the means of distinguishing them. Fig. 6 shows on the left three plants of Fynische Bortelder and on the right three of Bangholm's. The distinguishing characters of finger-and-toe disease are evident under the microscope, and in doubtful cases one may be obliged to have recourse to this method; but as a little practice serves to distinguish the two without difficulty. The first thing to be noted is the presence of characteristic spindle-shaped swellings on the side roots (see Fig. 6, A, B and C). In general shape they may somewhat resemble the swellings on the roots of turnip-like hybrids (cf. Fig. 2, C), but cannot be confused with them, as the surface of the finger-and-toe swellings is smooth and they never show the closely-placed constrictions characteristic of the swellings on the roots of the hybrids. Though these swellings do not occur on every diseased root, they are sure to be found among a number of roots taken from a field where finger-and-toe is prevalent. Another distinguishing feature of the finger-and-toe swellings is that they often show the beginning of cork formation on the upper part; this never takes place on the nodosities of hybrids. On the larger finger-and-toe swellings a considerable development of rough greyish-brown cork generally takes place; the dark central part of Fig. 6, E, is a cork layer of this nature. Attention should also be drawn to the swellings near the tip of the root in Fig. 6, F; a swelling in that position fairly frequently occurs in both swedes and turnips attacked by the disease. In this case it differs from the nodosities of hybrids in narrowing equally above and below. Finally, a special characteristic of the deformed parts of roots attacked by finger-and-toe disease is the almost invariable presence of irregular brown streaks in the flesh, as may be readily seen on cutting the swellings across; such streaks never occur in the nodosities or swellings due to hybridisation.

The elucidation of these points has been of considerable importance for the seed trade. To this work is due the fact that in the season 1913-14 the wholesale dealers in turnip seed were able to undertake to guarantee the truthfulness to variety and strain of the Danish swede and turnip seeds sold abroad, in conformity with the law of the 8th of June 1912 on penalties for erroneous designation of goods. This law gives the foreign purchaser the right to full compensation in case the crop grown from the Danish swede or turnip seeds contains so many hybrids or degenerated roots that the yield



is distinctly reduced. The fact that the Danish wholesale seedsmen have been able to assume without risk such a comprehensive liability for compensation is due to the demonstration by the Experimental Organization of the certain characters by which swede and turnip hybrids can be recognized. In careful selection of Danish strains of swedes and turnips carried out for a number of years, the seedsmen have thus been in a position to undertake such a thorough elimination of all plants tending to degenerate that the stability of the strains may now be considered as thoroughly established.

### Present State of Fruit Growing in Spain. (I) (The Principal Fruit Trees of the Rosaceae).

by

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Almost all the fruit trees grown in the different parts of the world grow in the open in Spain; from the chestnut woods which cover the northern slopes of the Cantabro-Asturian mountains to the plantations of banana and guavas which adorn the orchards of Malaga and Cadiz, almost all kinds of fruit trees are well represented.

Limiting ourselves to the most widespread fruit trees, we shall consider pear and apple among hard fruit, and peach, apricot, plum and cherry among stone fruit.

*Conditions and importance of fruit growing in Spain.* — The Iberian Peninsula, covering seven degrees of latitude from the Straits of Gibraltar to the Cantabrian coast, and possessing various conditions of altitude, aspect, soil and geological formation, is very favourable for the growing of the above fruit. Indeed fruit is grown in all the 47 provinces on the mainland, and in some districts, such as Aragon and Rioja, it forms one of the chief sources of wealth.

The progress of fruit growing in Spain has been slow, on account of the former slowness and insufficiency of the means of transport. The development of the railways led to the spread of the use of fruit among all classes and to the extension of the plantations, though not to the same extent as in some other countries, nor in all the districts suitable for fruit.

Only meagre data on the fruit plantations of Spain and their products are available. According to the "Avance estadístico de la producción de frutas en 1910," (Statistics of the production of fruit in 1910), published by the General Direction of Agriculture, Industry and Commerce, the total area under the above-mentioned kinds of fruit is 121 526 acres, distributed as shown in Table I.

(1) See also: JUAN M. PRIEGO, "The Present Condition of Citrus Growing in Spain" *B. Feb. 1913*, pp. 162-167.





Fig. 2. -- Nodosities on roots of Swede-like hybrids.



Fig. 6. -- Swedes and turnips by *Plasmodiophora Brassicae*.



*A*                      *B*                      *C*                      *D*

Fig. 3. — Nodosities on roots of turnip-like hybrids.



Fig. 4. — Swellings and nodosities of Turnip-like hybrids.



Fig. 5. — Adventitious shoots on a rape-like hybrid.

TABLE I.  
*Acreage under hard and stone fruit in the various regions of Spain.*

	Acreage under					
	Plums	Apricots	Peaches	Cherries	Pears	Olives
New Castile . . . . .	1 163	479	329	739	1 050	1 055
La Mancha and Estremadura . .	630	472	615	151	874	719
Old Castile . . . . .	2 339	412	398	1 121	3 441	3 300
Aragon and Rioja . . . . .	1 880	595	3 372	734	4 707	2 702
Cataluña . . . . .	472	363	183	978	415	72
Galicia and Asturias . . . . .	454	114	1 314	2 868	6 219	22 665
Navarre and Vascongadas . . .	220	190	494	514	3 866	11 399
Catalonia . . . . .	625	370	1 408	346	1 976	2 396
Levante . . . . .	590	2 440	2 932	1 000	1 146	2 408
Eastern Andalusia . . . . .	1 647	457	1 220	672	897	1 015
Western " . . . . .	1 892	217	576	242	1 028	1 974
Balearic Isles . . . . .	370	2 223	—	—	—	1 235
Canaries . . . . .	99	123	173	—	642	442
Totals . . . . .	12 382	8 462	13 012	9 364	26 261	52 045

The numbers in the Table are only approximate and leave out a large number of fruit trees scattered among other crops, or in gardens, vineyards and fields, since the precise valuation of the surface they occupy is very difficult.

The estimate of the amount of fruit produced is also below the reality. The fruit crop of 1910 was bad almost all over the country, owing to late frosts and summer drought. The 300 000 tons to which such produce approximately amounts, valued at the average price of 15 pesetas per quintal (11s 10  $\frac{1}{2}$ d per cwt.), which was the price adopted by the Commission appointed for the study of the transformation of the tax on consumption, give a value of nearly £ 1 800 000. In the work of the above Commission the value of the average crop of the fruit here considered was taken at £ 1 920 000, being based on older data as to the acreage under fruit.

The exportation is of no great importance, as may be seen from Table II.

If the data concerning the acreage under fruit trees, the yield and the exportation be compared with those of other countries under conditions similar to those of Spain, it will be seen that the latter is still far from having taken full advantage of its favourable conditions. Nevertheless its production is increasing, though not so rapidly as that of some other crops for which the country is less suitable. The land not devoted to field crops, such as such of that which is still uncultivated and a great part of the vineyards

TABLE II.  
*Exportation of hard and stone fruit from Spain, 1907-11.*

	1907	1908	1909	1910	1911
	£	£	£	£	£
Apricots . . . . .	2 338	200	478	3 832	1 261
Peaches . . . . .	5 293	1 537	2 290	1 116	1 829
Apples . . . . .	19 641	4 808	15 006	3 649	6 507
Plums . . . . .	2 861	1 464	4 901	10 412	9 723
Other fresh fruit. . . . .	25 578	24 089	30 757	27 795	23 843
Fruit pulp . . . . .	36 841	32 330	37 533	63 298	60 142
Totals . . . . .	152 552	64 428	90 965	110 102	103 310

destroyed by phylloxera, is eminently suitable to fruit growing. The markets of the country are far from being amply provided, considering that the average amount consumed by the population is about 40 lbs., worth 2s 1½d, per head per annum. Whole districts consider fruit as an article of luxury. The exportation of fruits is stationary and very limited; England, Germany, Denmark, Sweden and Russia hardly know the pears and peaches of Aragon, Rioja and Lerida, the apricots of the Balearic Isles, Castellón and Murcia, and the cherries of Lugo, Orense, etc. France, whose consumption of fruit per head of population is four times that of Spain, exports fruit to the value of half a million sterling every year, and Belgium, which is inferior in extent to two Spanish provinces, reaches nearly the same figure.

*Distribution of fruit in Spain.*— Though fruit growing has not the same importance in all the provinces, in all of them fruit trees are grown. The various species are distributed as follows:

*Hard fruit.*— Pears and apples are cultivated almost throughout Spain. Table varieties have little or no importance in seven provinces, *viz.* Leon, Cuenca, Malaga, Huelva, Valladolid, Guadalajara and Seville.

The most important plantations of *pears* are those of Aragon (basins of the Ebro, Jalon, Jiloca and Guadalope), Castellón de la Plana, Burgos (districts of Aranda), Galicia (Pontevedra, Orense and Lugo), the mountainous districts of Andalusia, the Sierra de Córdoba and the territories of Baza and Guadix in the province of Granada. The first belt produces not less than 20 000 tons in average years; the pears are of such excellent quality that the Royal Household obtains its supplies from here. The varieties most extensively grown are Sanjuaneras, Deagua, D. Guindo, Bergamotas, and Roma; these and some winter ones are exported in ever-increasing quantities into the South of France.

The area under dessert *apples* is very nearly the same as the above described area. These apples, however, prevail in the Lerida district, extending also into the province of Gerona, in the Levante district, where the summer and early autumn varieties thrive very well, and in the province of Cordoba (Cordoba, Baena and Cabra).

The cider varieties of both species cover the northern slopes of the Cantabrian mountains in the provinces of Navarre, Guipuzcoa, Biscay, Santander and Oviedo, and the slopes and valleys near the coast in the territory of Pontevedra and Lugo (Galicia). The province of Oviedo is the greatest producer of cider. The total crop of all this belt is from 8 to 11 million bushels of cider apples.

*Stone fruit.* — The most important stone fruit is the *peach*, both for the acreage devoted to it and for the value of the fruit produced. It is grown in 40 provinces, but its produce is really important only in those of Saragossa, Teruel, Logroño, Lerida, Barcelona, Orense, Murcia, Jaén and Castellón. The first four provinces form a belt in the basin of the Ebro and its tributaries, producing an average of about 4000 tons of excellent quality. The free-stone and Pavia peaches of Lerida, the clingstones of Sástago and Escatrón, the yellow peaches of Campiel, and the large peaches of Saragossa are equal or superior to the most esteemed of other countries and supply Madrid, Barcelona, etc., during the season, following the earlier ones from Castellón, Valencia and Murcia. Of all these peaches a certain proportion is exported to Paris, London and Hamburg.

The southern belt of the province of Madrid and its valleys of the Tagus and the Tajuña are rich in various fruits, including productive and highly esteemed peaches and plums. Its principal centre of production is Aranjuez which supplies a good deal of the fruit consumed in Madrid.

Under the form of "orejones" (peaches halved and dried), great quantities of the crop are prepared and preserved, as it would be difficult to export them fresh to great distances. The dried peaches of Malaga and Logroño are held in high esteem everywhere.

In point of importance the *plum* follows the peach. It is more regularly distributed, thanks to the greater resistance of its fruit to bad weather. Toledo, Granada, Almeria and Lerida rival Aragon in the production of plums. Greengages are, to a certain extent, exported to Paris and other capitals. In the Llobregat territory, plums are grown with apricots. They are also widely spread in the above-mentioned belt of the province of Córdoba, whence they are also exported to a certain extent. This productive tree, so reliable in its yield and having the advantage of producing fruit easily dried or preserved, deserves to be held in still greater consideration than it is.

*Apricots*, which are the most exacting as to climate of all the species here mentioned, naturally occupy the most limited area. At the same time they are grown in 36 of the provinces of Spain and are totally wanting only in the North and in a part of the North-west of the peninsula and in some provinces of Western Andalusia. The apricots of Toledo are distinguished by their keeping quality and resistance to carriage, due to the fact that they acquire a pleasant taste before they are quite ripe. The apricots of Levante are large, tasty and early. In Murcia they form part of the early produce exported to Central Europe. In the Balearic Islands they occupy about 2500 acres and give rise to an important export trade of fresh fruit and pulp for preserves; indeed they constitute the most valuable crop.



*Egriots, morellos and cherries* have been abandoned in a number of provinces; the central plateau of the two Castiles and the provinces of Salamanca, Lugo, Orense, Lerida and Castellón are the greatest producers of these fruits. Those grown along the Segre and the Cinca are profitably exported. The still earlier cherries of Sagunto and the Segures valley are packed in small boxes and sent to Paris. The large cherries, such as the Costalera, Corazón de Cabrito and some others with very firm flesh, being suited to extensive farming and possessing great resistance and keeping qualities, are especially advisable in the large bare plains and in the small ranges of Tertiary calcareous rocks so frequent in Spain.

*Observations on cultural methods in Spain.* — In almost all the above mentioned districts fruit trees are intermingled with other crops, chiefly in market gardens. In some districts, especially the Basque provinces, fruit trees are planted on grain land or pasture; in some parts of Arago and Levante they are grown in vineyards; less frequently, as in the Tor neighbourhood, they form pure plantations.

The drawbacks of intermingled crops, especially of trees with field crops are well known. The former cast an injurious shade on the latter and these in their turn take up much moisture and plant food from the soil. Manure to suit all the different plants cannot be prepared, and the operations of tillage and irrigation do not always coincide. This interplanting of fruit trees with other crops, which is so frequent in Spain is, we believe, one of the chief causes of the fact that fruit growing is not so profitable as it might be. The farmer devotes more care to the garden crops, the cultivation of which he generally knows better, whilst he is ignorant of the practice of treating and pruning the fruit trees.

In these various types of fruit plantations the different kinds of tree are generally mixed together. But besides these plantations there are many scattered trees, chiefly apricots and plums, in either enclosed or open fields.

*Economic data. — Yield of fruit trees in Spain.* — If the returns of fruit growing were to be estimated upon the figures supplied by the "Avance" of the General Direction of Agriculture, to which we have already referred, the conclusions would not be very favourable. The figures are the following:

	Yield per acre
	— cwt.
Pears . . . . .	51
Apples . . . . .	58
Peaches . . . . .	30
Plums . . . . .	43
Apricots . . . . .	40
Cherries . . . . .	40

But, as we have already said, the 1910 crop was generally bad and these yields are certainly inferior to the average. The data collected by us in the chief producing centres are the following:

*Pears.* — Standard pears begin to produce at the age of 15 years. When in full bearing they yield about 1 cwt. of fruit per tree. The value

this fruit varies, like that of all other kinds, with the variety and the season. Those produced in Aragon, sold on the spot under normal conditions, may be valued at 8s per cwt. A certain proportion of the good autumn and winter varieties are exported and fetch more than double the above price. In the province of Saragossa the variety most esteemed for exportation is the De Roma. In a regular plantation in rows about 100 pear trees are sown to the acre; they yield about 5 tons of fruit, worth about £40.

*Apples.* — The bearing and yield of apples vary still more than in the case of pears. We believe that the figures of the above "Avance" may be taken as correct for average years. The apples supplied to the Madrid market come for the most part from the Valenza and Teruel districts, where their price ranges between 6s and 12s per cwt.

*Peaches.* — Peach trees begin to bear at the age of four or five years. Their average yield may be taken at 44 lbs., and as in one acre there are about 20 trees, the yield per acre is about 47 cwt. of fruit; in normal seasons this is worth, at the orchard, never less than 12s per cwt., the gross returns being thus about £28 per acre. Peaches are the most esteemed fruit, even in the home market; especially choice and early fruit fetches high prices. They are frequently sold by the dozen, and on the spot where they are grown are large peaches of Saragossa and Lerida, or early or late varieties, command as much as 1s 7d per doz. The peaches of the Segre, Cinca and Llobregat valleys supply Barcelona, and some are shipped from that port. A certain amount of exportation takes place from Castellón de la Plana. The peaches of Saragossa, Teruel and Rioja are consumed in the interior and used in the local preserve factories.

*Plums.* — This tree is grown almost always as a standard and develops well in the whole of Spain, producing, when fully grown, as much as 130 lbs. of fruit per tree. Of all the fruit trees it is the one least frequently grown by itself. The price of its fruit varies very much; its dimensions, form, colour, taste and keeping qualities (the latter never being high) also differ largely in the different varieties. In years of abundance their price falls as low as 5s 5d per cwt. Greengages, when well packed, are worth eight or ten times as much on the great markets.

Señor GAJON, a well-known fruit grower of Saragossa, calculates the yield of a plum tree as follows: 10d at the age of six years; 6s 4d at twelve years; 1s 6d at sixteen; 11s 10d to 15s 10d at twenty and upwards, always provided that the fruit be placed on a good market.

*Apricots.* — The yield of this tree, which is never very regular, may be valued at 132 lbs. per tree every other year. Reckoning 112 trees per acre (real distance apart about 20 feet), the average produce per acre per annum would be about 66 cwt., which, at a minimum price of about 10s per cwt., amounts to an average gross income of £33 per acre.

The plantations of Murcia, Aranjuez and Toledo supply the Madrid market; Castellón and the Llobregat valley that of Barcelona. These districts and Murcia export a good number of boxes. This fruit has acquired considerable importance in the island of Majorca, where it now occupies

about 2250 acres and is yearly extending. The apricot preserve exported every year from the Balearic Islands is valued at £24 000.

*Cherries.* — The produce of this tree, which is more reliable than that of the apricot, is estimated at 330 lbs. per tree; the fruit of good varieties sells at 8s to 12s per cwt. Where the cherry trees attain their full development not more than 40 can be planted to the acre, in which case the gross returns may be estimated at least at £40 per acre.

The first cherries to appear on the Paris market are from Spain. Unfortunately the number of boxes exported is limited, as the production barely keeps pace with the home consumption and it is difficult to understand why a fruit that is in such demand both at home and abroad is not more widely planted.

*Cost of production.* — The cost of producing fruit varies very much according to the locality and the systems of cultivation adopted; the difficulty of ascertaining such cost is greater when the fruit trees are interplanted with other crops. When they are grown by themselves, the cost of production is but little higher than that of growing olives. There is no doubt, however, that they leave the grower a satisfactory margin of profit and that fruit growing is destined to develop considerably in the near future.

## The Dairy Industry in Italy at the Present Time

by

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### STATISTICAL DATA ON MILK PRODUCTION.

No accurate and recent statistics on milk production in Italy are available, and the data given in the present paper have been obtained indirectly or are merely personal estimates. The last live stock census, taken in 1908 by order of the Department of Agriculture, forms a positive point of departure; from it are taken the following figures dealing with the classes of animals producing milk:

	Number of head
Sheep . . . . .	11 162 926
Cattle . . . . .	6 198 861
Goats . . . . .	2 714 878
Buffaloes . . . . .	19 366

The dairy industry depends chiefly on sheep and cattle. The scarcity of the bovine species, which is the more important in milk production, is quite evident both when the numbers are considered in relation to the number of inhabitants, or when compared to various other European states. With regard to the distribution of the cattle over the twelve regions of Italy,

more than half the total numbers, or 3 662 813 head, are found in the valley of the Po, and of these over one million are in Lombardy, where the density of cattle is at its maximum; Emilia, Veneto, Piedmont and Sardinia follow in the order given at no great distance apart. Lower Lombardy, which includes the fertile irrigated plains of Pavia, Milan, Cremona, Brescia, Mantova, is the zone of most intensive milk production. Owing to irrigation, our crops of hay may be obtained annually, and on the so-called "marcita" fields, near Milan and Pavia, the number rises to seven or eight. The quadrangle bounded by the rivers Ticino, Po and Adda and the parallel running through Milan is characterised by its dairy farming, the milk production per unit area or per head of the population being higher than in any other part of the world. Emilia too, in the provinces of Reggio, Parma and Modena, has made great strides since 1881 with regard to increasing the number of cattle, its forage crops and its milk production, so that to-day the density of cattle for the whole region (Emilia) is higher than that of any other whole region in Italy, viz. 18.1 per square mile. In fact the number of cattle increased in all parts of Italy from 1881 to 1908, the total increase being almost one and a half million head, or about 30 per cent., and its quality has improved at the same time.

Sheep are most abundant in the southern Adriatic region, where about 10 million head are found, while the southern Mediterranean region, Sardinia, Latium, and Tuscany follow in order, having over a million head each. The density is highest in Latium. In a general way it may be said that the number of cattle per acre decreases going from north to south while on the contrary the number of sheep per acre increases. Goats abound in the southern Adriatic region but in no other parts. Buffaloes are pastured on swampy ground where no other domestic animal could live; herds are found in certain localities in Latium and in the southern parts of the country (Salerno, Aversa, Foggia, etc.)

As the 1908 census does not state the number of females which may be considered milking stock in each of the above classes of live stock, an approximate estimate must be made to arrive at the milk production in Italy. Assuming that the percentage of milking stock in the total registered be 60, 70, 55, and 50 for cattle, sheep, goats and buffaloes respectively, then the numbers of milking stock in Italy would be approximately follows:

Cows . . . . .	3 600 000	head
Sheep . . . . .	7 800 000	"
Goats . . . . .	1 500 000	"
Buffaloes . . . . .	10 000	"

It is not easy to calculate the average quantity of milk produced by the above stock, owing to the heterogeneity of the breeds and to the dissimilarity of systems of management.

*Cow's milk.*—Leaving aside the question of breeds, there are two opposite systems of management of milch cows in Italy, viz.: permanent housing and free ranging. In the north, where milk is an important industrial

substance, the cows are housed permanently or almost permanently; this system is also in vogue in parts of Central Italy (Tuscany, Umbria), where, however, the milk is chiefly used for calf rearing. Free ranging is met with in the central regions beginning in Latium, in the southern part of the country and in the islands, where the milk is partly employed for calf rearing and partly for cheese making on a small scale. In the latter case yields are small owing to the not infrequent scarcity of fodder and to the exposure of the cattle.

Where milk production is carried on intensively, as for instance in Lombardy, calves are usually removed from their mothers a few days after birth and almost the entire production of milk is available for cheese making. In the central regions, on the contrary, the cows are never milked, but merely suckle the calves, in which case the period of lactation is greatly reduced. An intermediate system exists in Sardinia, where it is usual to milk the cows once a day during a part of their lactation period, *i. e.* during April, May, June, and October.

To estimate the average production of milking cows in Italy, those which are only used for suckling calves and those which are only milked for a very brief period should be excluded, *i. e.* about 1 000 000 head, which reduces the number of milking cattle from 3 600 000 to 2 600 000. The average annual production per head varies from 25 hectolitres (550 gallons) in Lombardy to 10 hectolitres (220 gallons) for Alpine cattle and 4 hectolitres (90 gallons) for free ranging cattle in Sardinia, so that assuming an average production of 12 hectolitres (265 gallons) for the above 2 600 000 cows the estimate will be conservative. On this basis 31 200 000 hectolitres (7 million gallons approx.) would be produced annually, of which part is used for direct consumption and part is worked up into other dairy products.

The population of Italy, consisting of 34 million inhabitants, consumes very little cow's milk, the consumption being highest in the northern provinces and least in the central and southern regions, where many Italians never drink cow's milk at all, partly because it is not customary to do so and the product is expensive, and partly because they use ewe's or goat's milk instead. The average consumption per head may be estimated at 18 litres (4 gallons) per annum, or 0.05 litre (0.1 pint) per day, which is a negligible quantity compared with the consumption in Germany, Denmark, Holland, Sweden and Norway. On this basis 6 120 000 hectolitres (150 million gallons) are consumed directly, leaving 25 080 000 hectolitres (550 million gallons) for the production of other dairy products.

*Ewe's Milk.* — The milk production of ewes varies from 100 litres (22 gallons) per annum in Sardinia to 40 litres (10 gallons) in some of the flocks on the mainland. Assuming a mean yield of 70 litres (15 gallons) per head per annum, the annual production of ewe's milk available for the dairy industry is 5 460 000 hectolitres (120 million gallons).

*Goat's Milk.* — Goats yield more milk per head than do ewes. In Sardinia their annual yield is estimated as 140 litres (30 gallons), but for present purposes 100 litres may be taken as the average figure per head.

After deducting the amount required for raising the kids. This is equal to a total annual production of 1 500 000 hectolitres (33 million gallons).

*Buffalo's Milk.*—Milking buffaloes may yield from 5 to 8 hectolitres (100 to 180 gallons) per annum, but the semi-wild state in which they are kept causes their milk yield to vary considerably from year to year. For present purposes their yield may be estimated at 4.5 hectolitres (100 gallons), which gives a total annual production of 45 000 hectolitres (1 million gallons).

The following table summarises the data dealing with the milk production of the bovine and ovine species, this being not only the most important source of supply but also the one capable of eventual increase.

	Cattle	Sheep
Total numbers (1908 census) . . . . .	6 198 861	11 162 926
Females . . . . .	3 600 000	7 882 727
Milking animals. . . . .	2 600 000	7 800 000
Average yield per head . . . . . galls.	265	15
Total annual production . . . . . million galls.	700	120
Milk used for direct human consumption " " "	150	—
Milk worked up industrially . . . . " "	550	120

It is important to emphasize the fact again that of the above figures, only those of the 1908 census are absolute, the others being the result of estimates.

#### UTILIZATION OF MILK.

*Cow's milk.*—This is put to three chief uses:

1. Condensation. — Carried out in two factories in Lombardy; only accounts for a very small proportion of the total produce. Milk powder is also prepared in small quantities.

2. Direct human consumption. — City dairies, which deal with this section of the industry, are to be found in the principal Italian cities, but even the most modern and up-to-date examples are very modest compared with the large establishments of this kind which exist in other countries, such as at Vienna and Berlin. Much improvement has taken place with regard to the handling of milk, but even now the greater part is sold by small local dealers. The retail price consequently varies with the abundance of the local production, and prices increase from North to South of the country, the minimum and maximum being 2*d* and 6 ½*d* a quart respectively. Of late years prices have tended to rise. The wholesale prices obtained in Lombardy and Emilia have risen gradually from 5*d* to 7.7*d* per gallon during the last ten years. In all the principal cities, the retail milk trade is subject to inspection by local hygiene officers.

3. Cheesemaking. — About five-sixths of the total milk production is turned into cheese, butter, and their bye-products. The factories dealing with this section of the industry may be grouped into three classes: private factories, where the producer of the milk turns it into cheese and butter

himself; industrial factories, such as exist in Lower Lombardy, where the milk is bought from the producers and worked up—as much as 4 400 gallons being dealt with per day; and cooperative factories, which are chiefly to be found in the Alpine districts, but which also exist in Emilia, while a few isolated examples may be found in Sardinia and in the South. The number of these cooperative factories fluctuates considerably, as new ones are started every year while others close down. They are most numerous in the province of Udine, where they number several hundreds, while the total number in the country must amount to almost a thousand. The most modern example and the one which deals with the largest quantity of milk is that at Soresina (Cremona prov.).

*Cow's milk cheeses.* — These are of three kinds :

1. Moulded cheeses—such as Stracchino, Gorgonzola, Robiole, Fresca.
2. Hard cheeses — Grana (including Parmesan, etc.) Fontina, Bitto Asino, Montasio, Bra; the skim milk (so-called Swedish) cheeses; "Margarinati" cheeses (in which butter fat is wholly or partially substituted by margarine); and the Swiss cheeses, Emmenthal, Gruyere.
3. Soft cheeses - whose name alters with their shape: Caciocavallo, Provolone, Scamorza, etc. Ricotta, a white curd sold in Italian cities, is usually a bye-product obtained from whey, but may also be prepared from fresh milk.

Stracchino and Gorgonzola are chiefly produced in Lombardy and to a slight extent in the adjoining plains of Piedmont; Fresca is a Sardinian speciality; grana comes from Milan, Southern Lombardy and Northern Emilia; Fontina and Bitto from the Alps to the west and north; Asino from Vicenza; Montasio from Udine, and Bra from Piedmont. Swiss cheeses are made in Lower Lombardy and the soft cheeses which used to be a speciality of the Abruzzi, Latium and the South are now also being manufactured in the North.

Butter is chiefly produced in Lombardy, either in the cheese factories or in special creameries; appreciable quantities also come from Veneto, Piedmont and Emilia. In certain southern provinces butter-fat is enclosed in a kind of bag made of soft, elastic curd, the whole being called "manteca".

With regard to bye-products, lactose is only prepared by a very few factories; the extraction of casein is rather more general, and is supplanting the manufacture of skim-milk cheeses, which is no longer remunerative on account of over production. Other bye-products are "vituline", a kind of calf meal, and dairy waste, which is used for pig feeding.

*Ewe's Milk Cheeses.* — This group of products has developed considerably of late years owing to their growing importance in the country's exports, and flocks are in consequence receiving more attention. The type of cheese varies from place to place, as a considerable proportion is still made for local consumption; the following may be mentioned as typical examples: Pecorino Romano, Cotrone, Moliterno, Pecorino Sardo, Cacio fiore, Incanestrato di Sicilia. Of these, the Pecorino has acquired commercial importance during the last twenty years. It originated in Latium, which is still the centre of production, but its manufacture has been considerably

extended in Sardinia, where up-to-date cheese factories have now been erected for the purpose.

*Goat's Milk Cheeses.* — These are small and only made for local consumption. Goat's milk is frequently mixed with cow's milk or ewe's milk to form so-called "mixed cheeses".

*Buffalo's Milk Cheeses.* — Small, round, soft cheeses are made with buffalo's milk, which is rich in fat. These are somewhat sweet with a pronounced flavour and find a market in the southern towns where they are sold under the names of: mozzarella, uova di bufala, provole, provature.

#### VALUE AND AMOUNT OF CHEESE PRODUCED.

In estimating the amount of cheese produced, it is assumed that:

	cow's	milk	yields	7 per cent.	of cheese
	ewe's	"	"	15	"
	goat's	"	"	10	"
	buffalo's	"	"	20	"

After deducting from the cow's milk the amount used for butter-making, the annual production of which is estimated at about 50 000 tons, the amount available for cheese making is reduced to 23 000 000 hectolitres (505 million gallons). The production of cheese is, therefore, as follows:

cow's milk	16 100 tons
ewe's	8 100 "
goat's	1 500 "
buffalo's	90 "
total	25 790 tons

To obtain the value of the total produce, butter and cheese are taken at the wholesale prices of 260 lire per quintal (11.8d per lb.) and 160 lire (7.3d per lb.) respectively as follows:

	annual value
butter	£ 5 200 000
cheese	" 16 505 000
bye-products	" 640 000
total	£ 22 345 000

#### FOREIGN TRADE.

*Exports.* — According to statistics published by the Ministry of Finance, exports of dairy products in 1913 were as follows:



	Amount tons	Value £
Fresh or sterilized milk . . . . .	226	18 108
Fresh, sterilized and peptonised cream . .	0.75	528
Condensed milk, unsweetened . . . . .	8	3 620
"    "    sweetened . . . . .	251	120 588
Fresh butter . . . . .	242	286 656
Salted butter . . . . .	30	35 032
Cheese, Grana . . . . .	916	916 480
"    Swiss . . . . .	94	79 084
"    Pecorino . . . . .	917	880 896
"    Caciocavallo . . . . .	211	227 748
"    other hard types . . . . .	155	148 808
"    Gorgonzola, Stracchino . . . . .	916	696 324
"    other moulded types . . . . .	7	4 916
Total . . . . .		3 418 788

It will be seen from the above table that the largest exports consist of Grana, Pecorino and Gorgonzola cheese. The principal importing country is the United States, followed by Argentina, the cheese being consumed there by the large Italian immigrant population. Gorgonzola, however, goes chiefly to England, France and Switzerland.

Exports of cheese, have increased steadily since 1871, as shown by the following figures :

Year	Exports tons
1871 . . . . .	176
1879 . . . . .	266
1883 . . . . .	383
1887 . . . . .	503
1894 . . . . .	722
1899 . . . . .	1 043
1902 . . . . .	1 308
1906 . . . . .	1 919
1907 . . . . .	2 114
1911 . . . . .	2 785
1912 . . . . .	3 062
1913 . . . . .	3 277

Exports previously consisted almost exclusively of Grana, but both the amount and the number of kinds exported have now largely increased.

*Imports.* — A little butter and a considerable amount of cheese (about one-sixth of the export value) are imported annually, the imports for 1913 being :

Butter . . . . .	40 tons
Swiss cheese . . . . .	450 "
Other hard cheese . . . . .	97 "
Soft cheese . . . . .	12 "

Total annual cheese imports . . . 559 "  
valued at £549 868.

The cheeses mostly come from Switzerland; other hard cheeses are mostly Pecorino from the Levant. Imports were at their highest in 1887, when they reached 1235 tons; then they decreased rapidly and remained practically stationary at 450 tons until 1913.

SECOND PART.  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

592 - **Agricultural Education in South Africa.** — *Journal of the African Society*, Vol. XIII, No. 51, pp 288-295. London and New York, April 1914.

Agricultural education in South Africa is controlled by the Union Department of Agriculture, and under this head are embraced the activities of four Schools of Agriculture with Experiment Farms, eight Experiment Stations, and four Stud Farms, also a Household Science branch. For the better administration of these Institutions, a separate division of the Department was recently created, under the control of one of the Under Secretaries. There exist, in addition, Experiment Stations connected with the work of the Tobacco, Cotton, Horticultural and Botanical Divisions, but these are directly under the control of the Chiefs of these Divisions.

The annual vote for agricultural education, inclusive of salaries, general maintenance, and development, amounts to about £120 000, but this amount does not include grants through loan funds or votes on the Public Works Department's estimates for buildings. During the current year these amounted to no less than £60 000.

The principal schools are:

A. *Cape Province*:

1. EISENBURG, the oldest established of the Schools, with between thirty and forty students, is situated about thirty miles from Cape Town. Area of station 1 700 acres. Special features at this institution are horticulture, viticulture, wine-making, cereals and tobacco (Turkish).

2. GROOTFONTEIN, outside the town of Middelburg (Cape) with about eighty-five students. Area of station 25 000 acres. Special features at Grootfontein are agriculture (including irrigation under Karroo conditions), ostriches, Merino sheep and Angora goats.

B. *Transvaal Province*:

POTCHEFSTROOM, about eighty-three miles to the southwest of Johannesburg, with about sixty-five students. Area of station 4 000 acres. Spe-

cial features of the instruction are agriculture representative of High-Veldt conditions, cultivation of crops under irrigation and otherwise, cattle, maize and other cereals.

*Natal Province :*

CEDARA, fourteen miles to the north of Maritzburg. The station covers about 3600 acres, and has some thirty students. Special features are sub-tropical agriculture, forestry (including wattle growing), cattle and maize.

*Orange Free State Province :*

There is no similar institution at present, but one is in course of establishment at Glen, near Bloemfontein. Arrangements have been made to receive students in 1915. A farm was purchased for the purpose at a cost of £20 000, and £40 000 has been provided on "loan funds" for the erection of the necessary buildings.

593 - **Technical Organization in German East Africa.** — *Deutsches Kolonialblatt*, Year XXV, No. 2, pp. 66-67. Berlin, January 15, 1914.

The following information has been received concerning the projected technical organization in German East Africa and the foundation of a native school for training practical mechanics at Daressalam :

The "Kolonial Wirtschaftliche Komitee" proposes opening three technical bureaux in the colony at Daressalam, Tanga and Lindi. These will be placed under the direction of competent certified engineers who have already had much experience in the colonies and will act as central consulting bureaux on all technical matters. The engineers will visit existing machinery on the plantations, advise, suggest improvements, etc. No fees will be charged for consultation other than the travelling expenses of the engineers.

At the same time a school for training practical native mechanics will be erected at Daressalam. The Committee have already rented a plot of land (23 680 square feet) from the Government up to October 1, 1919. The cost of building the school and its working expenses for the years 1914, 1915 and 1916 will be defrayed by funds voted by the metal and machine industry. The Government has already declared itself willing to instruct its officials in the different localities of the colony to select the most promising youths for instruction and to send them to the school. The number of pupils is at present limited to thirty.

The objects of the school are the following :

1. To train native mechanics and engine drivers. Only youths who have had some preliminary education and who are accustomed to working will be admitted. As encouragement they will get regular pay as soon as they enter the school.

2. To provide the railways, mines, internal navigation companies, factories and plantations in the colony with cheap technical labour, and, in time, to supply other German colonies also.

3. To act as an experiment station where German machines and implements will be tested and compared with foreign ones. People in the colony who are interested in machinery will be invited to attend the tests in order

to encourage useful discussions, and the Government will also be represented.

The education given in the school will be chiefly of a practical nature and will be adapted to the character of the natives. The first course will consist in rendering them familiar with all smiths', mechanics' and fitters' work, with the management of agricultural machinery and with the carrying out of all sorts of repairs. The second course will be more specially devoted to rendering the pupils capable of managing engines of all kinds, *i. e.* steam ploughs, machinery for hemp, cotton, rubber, etc., motor cars and boats and their repairs.

The machines and implements of the permanent exhibition will be included among the material available for the school. At the examinations held at the end of the course a Government commission will be present.

The chief stimulus to the foundation of the above school has been the scarcity of people capable of managing the cotton harvesting and other machines needed in the colony — a want which has hitherto been a serious handicap and prevented the extended use of machinery.

**594 — The New Standards adopted in Germany for the Trade in Sugar-Beet and Mangel Seeds.** — EDLER, W. in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 8, pp. 268-277. Stuttgart, April 15, 1914.

Owing to the difficulties which have arisen from alterations of the so-called Magdeburg standards, formerly universally recognized in the German beet-seed trade, the interested parties have drawn up a new set of rules. These differ from the earlier ones in that mangel and sugar-beet seeds are treated separately; further, instructions for the taking of samples and for the calculation of the deduction to be made on seeds not coming up to standard, but yet saleable, have been added.

*German standards for the trade in sugar-beet seeds (1914).*

The following bodies have taken part in the drawing up of the clauses given below: Ausschuss für Handelsgebräuche (representing the Deutscher Landwirtschaftsrat, Deutsche Landwirtschafts-Gesellschaft, Bund der Landwirte, Reichsverband der deutschen landwirtschaftlichen Genossenschaften für Deutschland and Vereinigung der deutschen christlichen Bauervereine), Verein der Deutschen Zuckerindustrie (Crude-sugar factory section) and the Gesellschaft zur Förderung deutscher Pflanzenzucht. These are valid where no other agreements are in force.

§ 1. — The sugar-beet seed should be delivered in good condition, fit for use, and, except for the screening necessary in cleaning, not graded according to the size of the clusters. The seed must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — The seed should contain at least 85 per cent. of dry matter (15 per cent. moisture). It is saleable with the dry matter down to 83 (17 per cent. moisture), but in that case the difference must be allowed for in the price (formula, § 5).

§ 3. — The purity should be at least 96 per cent (pure seeds after subtraction of impurities including clusters passing through a 2 mm., = 0.08 in., sieve). Seed is saleable down to 94.5 per cent., but the difference must be made up (formula, § 5).

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed . . . . .	60 000
b) medium-cluster seed . . . . .	65 000
c) small-cluster seed . . . . .	70 000

Of this number, 70 per cent. must be up in 7 days.

One hundred clusters must give in 14 days a minimum of seedlings as follows :

a) large-cluster seed . . . . .	80
b) medium-cluster seed . . . . .	75
c) small-cluster seed . . . . .	70

Large-cluster seed is reckoned as containing not more than 40 clusters to the gram, medium-cluster 41 to 50, and small-cluster 51 or more.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

If the price is to be reduced under *either* § 2 or § 3, the reduced price is obtained by the following formula :

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}};$$

but if *both* § 2 and § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96}.$$

§ 6. — In the absence of any other agreement, samples must be taken within three days of the delivery of the goods, and by a sworn sampler. The directions for sampling are given in the appendix.

§ 7. — The determination of the conformity to agreement of the seed delivered is made by a station belonging to the Union of Agricultural Experiment Stations of the German Empire (Verband landw. Versuchsstationen im Deutschen Reiche) according to the method prescribed by this Union.

Each of the parties has the right to stipulate that the examination be made by a particular station belonging to the Union. The average of the two results is taken. Either party may also require a decisive analysis; no reasons need be given for this, but notice must be sent in within four days of the receipt of the first results; such analysis is to be made by a third station, selected by agreement or by drawing lots. In the demand for the decisive analysis it must be stated which determination is to be remade. In this case the average of the decisive analysis and the one which comes near-

est it on the disputed point is taken ; if the decisive analysis is half way between the other two, it is accepted.

Each party pays for his own original analysis, while the decisive analysis is paid for by the party requiring it.

§ 8. — If the presence of foreign beets, such as mangels, in the seed is complained of, a cultivation experiment is to be carried out in the same or the following year, using a certified seed sample. This is to be entrusted to an experiment station selected as for the decisive analysis. Each party may send an expert to judge of the result ; the director of the station fixes the day for this and acts as umpire.

*Appendix. — Directions for sampling sugar-beet seeds.*

1. *Taking the sample.* — Samples must only be taken from unopened consignments in sacks ; these must be so arranged that their number can be counted, or, if they are piled up, fairly accurately estimated. The lots must also be labelled in such a way that no doubt can arise as to their identity.

If the lot numbers more than 100 sacks, a sample must be taken from at least every twentieth sack ; if there are between 20 and 100 every tenth must be sampled, while for fewer than 20 sacks half must be sampled.

The sampler chooses the sacks from which he wishes to take samples ; these should be well distributed through the lot ; further the different samples should come from different parts of the sacks, and for this purpose he may have a certain number of the sacks emptied. At the request of one of the parties concerned, all the sacks to be sampled may be turned out. If, for want of room or other reasons, it is not practicable to empty the sacks, this fact must be noted in the report. The use of a sample bore is only allowed provided there is no possibility of its damaging the seed.

The sampler must be provided with the necessary labour for the work of sampling.

Sampling in a railway truck is allowable ; the same directions apply in this case.

2. *Treatment of the sample.* — The average sample made up from the small portions is thoroughly mixed and then divided into separate samples according to the number of analyses required.

The samples for the determination of moisture and purity are to be enclosed in clean and dry air-tight vessels of glass or tin ; the openings are then to be sealed with sealing-wax, rubber, wax or some similar substance ; ground-glass stoppers should be greased. The samples must be tightly pressed into the glasses or tins. Each sample must weigh at least 200 gms. (7 oz.).

The samples for the determination of germination capacity are to be preserved in cloth bags or double paper bags ; they may not be enclosed in air-tight vessels. Each of these samples must weight at least 200 gms. (7 oz.).

The samples must be sealed or leaded by the party or parties present in such a way it that is impossible to open them without damaging the cover-

ing. When the samples are sealed, the sampler must label them; for tins properly adhesive sealed paper label is used, for bags a tie-on label; in either case he must write on it the reference number from his diary, place and date of sampling, brand and number of the sacks making up the lot, name of the purveyor or receiver (even supposing him to be only temporarily in possession of the seed), and the apparent nature of the packing; this information he certifies by his signature. If the sample is taken in a railway truck, the number of the truck must also be entered on the label.

If required, the sampler must provide a duplicate copy of this label, describing the nature and appearance of the seal or lead.

The sampler must see to the provision of the implements and materials necessary for the sampling.

3. *Number and destination of the prepared samples.* — The sampler has to prepare, according to instructions, 4 or 5 samples in glass vessels or tins and the same number in cloth or paper bags. He must send off those required within twenty-four hours to the addresses furnished by the person under whose instructions he is proceeding. He must also send one duplicate sample each to the purchaser and the vendor, while one he keeps himself.

The samples should be kept in dry unheated rooms. The sampler must keep his sample for a whole year, and must not part with it or deposit it at his judgment except on the combined demand of vendor, purchaser, committer and receiver.

A duplicate copy of the label should be given to the temporary possessor, provided he is not the committer.

If the interested parties require it, the sampler may make more than 4 or 5 samples, in return for a proportionate fee, but these must only be at his seal.

4. *Obstacles to sampling.* — If the sampler finds himself unable to observe these instructions, he must abandon the sampling.

#### *German standards for the trade in mangel seeds (1914).*

The following bodies have taken part in the drawing up of the clauses set out below: Ausschuss für Handelsgebräuche (representing the societies mentioned above), Gesellschaft zur Förderung deutschen Pflanzenzucht, and Vereinigung der Samenhändler Deutschlands. These are valid where no other agreements are in force.

§ 1. — The mangel seed must be delivered in good condition and fit for use; it must belong to the variety named and must agree with the particulars of the other paragraphs.

§ 2. — As for sugar-beet seed.

§ 3. — As for sugar-beet seed, except that purity as low as 94 per cent. is allowed.

§ 4. — One kilogram (2.2 lbs.) of seed must give in 14 days a minimum of 60 000 seedlings. Of this number, 42 000 must be up in 7 days. The seed is saleable with only 50 000 seedlings per kilo, but the deficit below 50 000 must be allowed for in the price.



One hundred clusters should give in 14 days a minimum of 75 seedlings for large-cluster seed and 70 for small-cluster seed. The seed is saleable with these figures down to 70 and 65, but the deficit must be made good. Large-cluster seed is reckoned as containing not more than 45 clusters to the gram of pure seed, small-cluster 46 or more.

In calculating reduction of price, an excess or deficit of seedlings per kilo may be set against a deficit or excess of germinating clusters, but the minimum value must come up to the standard. At the same time no raising of price is allowable. For the calculation of the reduction of price the formulae given in the Appendix are to be used.

§ 5. — Seed not fulfilling the conditions of §§ 1-4 is not saleable.

§ 6. — As for sugar-beet seed.

§ 7. — Differs from that for sugar-beet seed in that the station to make the decisive analysis is not to be selected by drawing lots; if the parties cannot agree within eight days, the president of the Deutscher Landwirtschaftsrat nominates a station belonging to the Union. Further, in case of delivery contrary to agreement the vendor bears all the costs of analysis.

§ 8. — If the purchaser considers the colour (within the variety) of importance, he may propose a determination of this by germination tests; any complaint on this point must be made within eight days of the receipt of the examination certificate. If complaint is made as to the correctness or purity of the variety, a cultivation experiment made in the same or the following year, using a certified seed sample, is to decide the question. This is to be carried out by a station selected in the same way as for the decisive analysis. The result is judged as under § 8 for sugar beets.

#### *Appendix. — Directions for sampling mangel seeds.*

Unless carried out by a sworn sampler, the sampling takes place as follows:

For lots up to 10 packages, all the packages must be drawn upon in the preparation of the sample; with more than 10, one in ten must be used, with the proviso that at least 10 remain unopened.

Injured packages are not to be used even when accepted by the purchaser.

The packages selected are to be opened in such a way that samples may be taken from the top, the middle and the bottom, or else so that they can be turned right out and the seed well mixed; at least ten samples are then to be taken from the heap (top, middle and bottom). The samples so obtained are to be put together, carefully mixed and divided into at least four equal parts. Each of these parts must weigh at least 200 gms. (7 oz.).

The samples for the determination of moisture content are to be enclosed in air-tight glass bottles or tins (as for sugar-beet seed). Those for germination tests are to be packed in linen or double paper bags, and must not be kept in air-tight vessels. All must be labelled in such a way that their origin can at any time be ascertained.

An impartial witness must be called in for the sampling; he stamps the seals or leads of the closed samples with his seal. The sample remitted must be accompanied by the witness' certificate of sampling, on which it must be stated that the samples were duly taken in his presence. The other samples must be kept in a dry unheated room in case they should be required for further investigations.

The vendor has the right to have similar samples taken on the purchaser's property, at his own expense, for examinations which he wishes made. If both parties have had samples taken, each must send in his sample for comparison in case a decisive analysis is required; the average of these two samples is taken as the decisive figure.

*Formulae for the calculation of reduction of price  
on seeds below standard but saleable.*

In the formulae, the values for dry matter and purity may only be inserted if they are within the limits set out in the regulations.

A balancing of excesses and deficiencies is only allowable in germination values (see § 4 above). No latitude is allowed outside the limits for delivery given in the regulations.

If the price is to be reduced under *either* § 2 or § 3 the following formula is to be used:

$$\frac{\text{price agreed upon} \times \text{value of seed delivered}}{\text{guaranteed value}};$$

but if *both* § 2 and § 3 require a reduction, the price is obtained by the formula:

$$\frac{\text{price agreed upon} \times \text{actual dry matter} \times \text{actual purity}}{85 \times 96}$$

If reduction is to be made under § 4 it is obtained as follows:

$$\text{price agreed upon} \times \frac{\begin{array}{cc} \text{seedlings germinating} & \text{clusters germinating} \\ \text{in 14 days in 1 gm.} & \text{in 14 days} \\ \hline 60 & + \quad 75 \text{ (or 70)} \end{array}}{2}$$

In the last formula, the two figures for germination must both be entered, even when one of them is up to or above standard.

If reduction is required under §§ 2, 3 and 4, the corrected price from the second formula is substituted for "price agreed upon" in the last formula.

**595 - Agricultural Shows.**

*Argentine Republic.*

1914 Aug. 15-23. Buenos-Aires. — Agricultural show organized by the "Sociedad Rural Argentina".

*Belgium.*

1914 Aug. 29 (opening). Arlon. — Regional agricultural competition, organized by the "Société agricole de Luxembourg"; there will also be an agricultural exhibition, including several international sections. Address to "Secrétariat de la Société agricole du Luxembourg", Arlon, Belgium.

*Canada.*

- 1914 Sept. 3-12. Vancouver. — Agricultural and industrial exhibition.

*Egypt.*

- 1915 Feb. or early March. Cairo. — Agricultural show organized by the Khedivial Agricultural Society.

*France.*

- 1914 Sept. 11-13. Quimper. — Show of Breton Black-and-white Cattle. Also exhibition of agricultural machines and implements, and trials of potato-diggers.  
Dec. 24-28. Paris, Grand Palais. — International Poultry and Rabbit Show, held by the "Société nationale d'Aviculture de France". Address of the Society: 34, rue de Lille, Paris.  
1915 March 4-8. Nice. — Great Triennial Flower Show, organized by the "Société d'Horticulture pratique de Nice."

*Germany.*

- 1914 Sept. 19-23. Siegburg. — Provincial show, held by the "Landwirtschaftlicher Verein für Rheinpreussen."  
Oct. 3-5. Hamburg. — Fourth fat stock show.  
1915 May 8-11. Karlsruhe. — First fat stock show for Baden, organized by the city of Karlsruhe and the Chamber of Agriculture of the Grand Duchy of Baden.

*Italy.*

- 1914 Sept. 20-30. Quistello (Mantua). — Dairy industry show. Also national poultry show, interprovincial pig show and exhibition of agricultural produce.

*United Kingdom.*

- 1915 Edinburgh. — Competition for potato-planters. Address to: J. Stirton, 3 George IV Bridge, Edinburgh.

*United States.*

- 1915 Jan. 1-Dec. 31. San Diego (California). — International Exhibition, with the following sections: Agriculture; Food Products; Commerce and Industry; Domestic Economy.

596 — **Agricultural Congresses.***Austria.*

- 1914 Sept. 5-13. Göritz. — Ninth Austrian Wine-makers' Congress. Address: Geschäftsleitung des österreichischen Reichs Weinbauvereines, Wien III, Fasangasse 48.

*France.*

- 1914 Aug. 3 (opening). Lyons. — National congress on technical education in industry, commerce and agriculture. General Sec., 5 rue Jussieu, Lyon.  
1915 April 6-9. Marseilles. — 53rd Congress of the Sociétés Savantes.

*Hungary.*

- 1914 Sept. 6-17. Budapest. — Eighth Congress of the International Union of Forestry Research Stations. Excursions will include: Szabadka (trials of fixation of shifting sands, stands of *Robinia*); Királyhalom (Secondary Forestry School); Pusztá of Dóblát (old stands of Scots and Austrian pine, and plantations of *Robinia* carried out in a special way on shifting sands); Vadászerdő (forests of pedunculate oak, plantation of foreign trees and experimental plots); Gödöllő (Arboretum of the Archduke Joseph); Selmeczbánya (Central Hungarian Forestry Research Station, comprising: arboretum, nursery, experimental plots, meteorological station); Ohegy (domained forest); Lake of Csorba, at 4500 ft. — Persons wishing to attend the excursions and meetings should send their names to the Secretariat of the Union, 3 rue de Louvain, Brussels.

## CROPS AND CULTIVATION.

97. — **Variation in the Nitrate Content of the Soils in Scania, Sweden.** — WEIBULL, M.  
in *K. Lantbruksakademiens Handlingar och Tidskrift*, Year 53, No. 2, pp. 65-93.  
Stockholm, 1914.

The writer employed the Grandval-Lajoux method of estimating nitrates in soils, which proved very delicate and reliable. Samples were taken from different points of a soil and tested separately, not mixed to form a composite sample, as the variation from point to point may be considerable; care was also taken not to sample a soil twice in the same place, as each disturbance causes increased aeration and influences nitrification.

During five years the soil of a field was systematically tested for nitrates both on cropped and uncropped plots, to follow the variations due to season and soil management; manurial dressings were identical on the cropped and uncropped plots. The results are set out in Table I (p. 860); the treatment of the field was as follows:

1907. — Seeds: sown in June, dunged, ploughed and harrowed and sown with wheat on September 2.  
1908. — Winter wheat: received 180 lbs of nitrate of soda per acre on April 24, harvested on August 12, dunged and ploughed September 12.  
1909. — Sugar beet: received a dressing of nitrate of soda May 20, lifted October 21, ploughed November 15.  
1910. — Spring wheat: sown April 8, harvested in August, dressed with liquid manure and ploughed November 11.  
1911. — Peas: sown in May, harvested August 10.

The nitrate content never exceeded 22 parts per million on cropped soil, while on fallow land it rose to 33. Among the cropped plots, those under beets contained up to 14 parts of nitrogen, those under wheat and peas only 8 or 9 parts, and those under seeds least of all (*viz.* 1.5 parts), but as soon as the latter were dunged and ploughed up nitrates increased to 6 parts per million and continued to accumulate right up to November, developing a nitrate content of 21 parts per million. Then the content decreased owing partly to absorption by the growing wheat and partly to washing out by rain, a loss which was verified later on other fallow plots. In the spring, nitrates were scarce; nitrification began again at seeding time but the nitrate content only became appreciably higher after the application of nitrate of soda, *i. e.* towards the middle of May. During the early summer the nitrate content generally increased, as did nitrate assimilation, evidenced by the difference between cropped and uncropped plots.

*Influence of cultivations and vegetation on the nitrate content of soils.* — In 1910 a piece of new ley (clover and grass in equal quantities) was divided into three equal parts of 10 sq. metres (107 sq. ft.) each; one of these was left in seeds, the second was freed from grass and clover and

TABLE I. — *Nitrogen as nitrate in the soil to a depth of 12 in., parts per million.*

Month	1907		1908		1909		1910		1911	
	Seeds, winter wheat sown (°)	Winter wheat (°)	Cropped land	Fallow land	Cropped land	Fallow land	Cropped land	Fallow land	Cropped land	Fallow land
Jan.	—	2.5 1	3	—	3	—	—	—	3	—
Feb.	—	1.5 2.5	—	—	—	—	—	—	—	—
March	—	1.5 2.5	—	—	—	—	—	—	3 2.5 2 3	2.5 2
April	—	3 1.5 7	—	2.5 2	—	2.5 5	2 5.5 3.5	2.5 5.5 3.5 4.5	6 4.5 5 5	3.5
May	—	5 2.5 1	3 2.5	10.5 3	7 8 9	8.5 4.5 7	4.5 5.5 8	7 3.5 7 5	—	—
June	—	3 2.5 1.5	7 14	13 7.5 12	12 3.5 4	2.5 6.5 4.5 4.5	6.5 4.5 2 4	7 4	—	—
July	—	—	14 6	3.5 21 32	33 2.5 1.5 1.5	4 3.5 4	2 2 5 3.5	3.5	—	—
Aug.	1.5 6 7.5 8.5 9.5	1 2.5 1	1.5 1	1.5 16 14.5 11.5	1.5 4.5 2.5 5	8 5	2.5	—	4.5	—
Sept.	7.5 14.5 10 14	1 1.5 2	1.5 2	1.5 10.5 —	12 4.5 1.5 3	8 4 5.5	—	—	—	—
Oct.	20 14 20 21	3 —	1 1.5 2	16 16 7.5	1 2 1 2 2 2	—	—	—	—	—
Nov.	21.5 21 17 13.5 8	6 —	—	—	2 2	2 2	—	—	—	—
Dec.	9.5 6.5 4.5 —	—	1.5 4 2	7.5 8 5.2	1 —	2 —	—	—	—	—

(1) Samples taken every week.

(2) 1st, 5th, 10th, 15th, 1st of each month.

kept bare of vegetation and the third was dug over to a depth of 12 in. on March 8. Nitrate and moisture contents are given in Table II.

TABLE II.

Date	Nitrates as N in parts per million			Moisture per cent		
	In seeds	Bare, weeded	Dug	In seeds	Bare, weeded	Dug
April 8	1.5	2.0	1.5	—	—	—
" 21	2.1	4.7	2.3	—	—	—
May 2	2.8	5.3	4.0	—	—	—
" 11	1.5	3.7	6.5	—	—	—
" 21	1.8	4.7	5.7	—	—	—
June 1	1.7	5.7	14.0	—	—	—
" 10	3.3	7.0	18.7	5.3	8.6	9.7
" 19	3.7	6.8	14.0	—	—	—
July 1	4.3	—	12.0	—	—	—
" 10	2.0	10.3	19.7	—	—	—
" 20	3.0	9.7	24.0	—	—	—
Aug. 1	2.3	9.7	11.3	6.7	10.1	10.25
" 11	1.5	7.7	10.3	8.81	10.82	10.25
Mean . .	2.4	6.5	11.3			

Nitrate content of the control plot in seeds remained low, averaging 1.4 parts per million and reaching a maximum of 4.3 parts at the beginning of July when vegetation was already in an advanced condition; this plot was always driest. In the bare weeded soil the nitrate content was about three times as large and did not attain its maximum till later in July. In the dug over plot the nitrate content was about twice that of the second plot, but the moisture content remained approximately equal.

*Influence of nitrate content on yield.* — Samples of soil were taken throughout the growing season on a certain number of farms from plots having received a dressing of nitrate of soda, superphosphate and potash and from manured plots; these samples were analysed for nitrates. The results show that soils in Sweden do not generally contain sufficient nitrate to provide for the requirements of plants, and this is especially the case with land under cereals or grass; corn fields will only attain a nitrate content of 10 parts per million if they have been dressed with nitrogenous fertilizers and will reach their maximum at the end of May or beginning of June; grass fields are usually lowest of all. Land under root crops or fallow is usually richer, and root fields may contain as much as 10 parts per million towards the end of June. When land is broken up after harvest, nitrification be-

comes active and nitrates accumulate more than at any other time. The maxima reached earlier in the season are only maintained a very short time, for nitrification decreases and plant assimilation is active; on unmanured fields, nitrates become scarce after one or two months and crops suffer from starvation; on manured soils a somewhat higher nitrate content is maintained for some time.

The writer investigated the question as to whether it were possible to detect the point at which nitrogenous manuring becomes necessary. Soils under beets were analysed during July and August; the results are set out in Table III.

TABLE III — *Soils under beets.*

Place of trial	Yield on unmanured soil	Increase due to complete manuring	Nitrates as N in parts per million					
			July 1	July 11	July 21	Aug. 1	Aug. 11	Aug. 21
	tons	tens						
Alnarp 1909 . . . .	39.0	0.6	9.3	6.3	6.2	2.5	1.7	1.7
Barsbäck . . . .	35.6	3.5	13.0	6.7	—	4.0	3.7	—
Alnarp 1910 . . . .	41.3	4.0	10.7	6.3	2.8	3.7	5.0	2.1
Ola Siversson . . .	30.9	4.4	14.7	7.3	8.0	3.0	2.3	—
Alnarp 1908 . . . .	40.5	4.7	7.3	6.3	2.7	1.7	1.8	2.5
Månsson Önerup . .	33.1	6.6	7.7	4.3	—	2.3	2.3	—
Alnarp 1907 . . . .	30.0	6.6	8.5	8.0	2.0	2.5	4.0	1.2
Bomhög . . . . .	37.0	7.8	8.0	5.8	2.0	1.7	1.0	1.7
Mean . . . . .			9.9	6.4	4.0	2.5	2.6	1.9

In the course of the two months, the mean nitrate content fell gradually from 9.9 to a minimum of about 2 parts per million. If the time at which this minimum content is first observed in each case be considered in relation to the increase in the crop caused by the nitrogenous manuring, it would appear that when the depletion of nitrate (2 parts per million) occurs early in the season, *i. e.* before the beginning of August, a nitrogenous dressing causes a fairly large increase of crop, but that the increase is less considerable if the scarcity of nitrates does not make itself felt till the middle or end of August; these dates would be liable to modification with the character of the season. The nitrate content of plots dressed with nitrate of soda never sank to such a low level as that of the unmanured plots.

Under normal climatic conditions then, a nitrate content of 2 parts per million at the end of July in unmanured fields of beets would indicate the necessity of applying a nitrogenous dressing, while if this low level does not appear till the middle or end of August, the natural content of the soil would be sufficient for the crop. According to RÉMY, it is just in July that beets develop a high capacity for assimilation, so that the results obtained above would not be unexpected. Probably a similar

period of maximum assimilation exists for other cultivated plants and it would be of great interest to extend investigations to other crops. Three trials carried out with forage crops gave in one case a large increase with a nitrogenous dressing, in the second case an appreciable increase, and in the third no increase, while the nitrate content of the respective soils sank to the critical point (2 parts per million) in June and before August in the two first cases, while the scarcity was never apparent in the third case. In one trial with potatoes the nitrate content of the soil sank to 2 parts per million on July 1, and a handsome increase was obtained with a nitrogenous dressing. In three trials carried out with spring corn, scarcity of nitrates was observed in one case in May and in the two other cases on August 1 and August 11; response to nitrogenous dressing was only obtained in the first case.

598 - **Experiments on the Rate of Nitrification.** — BEESLEY, R. M. in *Journal of The Chemical Society*, Vols. CV and CVI, No. DCXVIII, pp. 1014-1024. London, April 1914.

The rate of nitrification was determined for the following substances: carbamide, thiocarbamide, uric acid, asparagine, glycine, acetamide, aniline sulphate, methylamine sulphate, ammonium oxalate and ammonium sulphate and a special form of apparatus was devised so as to enable samples of the nitrifying solutions to be withdrawn without exposing the contents to accidental contamination from the organisms contained in the atmosphere. A suitable mixed culture of hydrolytic and nitrifying organisms was obtained from the secondary contact beds of a local sewage works. The course of hydrolysis and nitrification in the various solutions was traced by means of periodic determination of the ammoniacal, "nitrous" and "nitric" nitrogen figures. The ammoniacal nitrogen was determined by direct Nesslerisation of diluted portions of the nitrifying solutions. During the early stages of fermentation the "nitrous" nitrogen was determined by means of the anaphthylamine and the sulphanilic acid test, but as the concentration reached 3 parts per hundred thousand, Duyk's volumetric method using iodine was adopted. The first appearance of nitric acid was detected by means of brucine and sulphuric acid, and the quantity of 'nitric' nitrogen was determined as ammonia by reduction with a zinc-copper couple.

No nitrification took place in the solutions containing thiocarbamide and aniline sulphate. Ammonia was produced in the latter to the extent of 90 per cent. of the original nitrogen in solution, showing that the aniline was merely hydrolysed. However, no phenol was detected, probably owing to its destruction by bacterial agency. Nitrification took place in all the other solutions at approximately the same rate. In the case of the ammonium salts there was a temporary disappearance of nitrogen between the 30th and 60th days of fermentation. This loss of nitrogen becomes noticeable before any nitrate makes its appearance, and since the oxidation from nitrous to nitric acid consists of only one step it appears that it is in some stage of oxidation between ammonia and nitrous acid that the nitrogen becomes non-realizable.



The writer therefore concludes that intermediate substances of the nature of hydroxylated ammonium radicles are formed in the bacterial oxidation of the ammonium radicle.

599 - **Humus in California Soils.** — LOUGHRIDGE, R. H. in *California College of Agriculture Experiment Station, Bulletin No. 342*, pp. 49-92. Berkeley, Cal., January 1914.

The soils of California are characterised by the presence of humus to beyond twelve feet below the surface. There is not the sharply defined change of the black humus colour to grey at a depth of 6 or 9 inches, characteristic of normal humid soils. In some of the heavy clay soils a change in colour takes place at a depth of three feet, but for the most part the change in tint is very gradual downward through many feet. The average quantity of humus in 109 Californian soils is 1.35 per cent. for the first foot and a sum of 3.17 per cent. for the first three feet, equivalent to about 126 800 lbs. per acre. The average humus content of 280 humid soils of the United States is 2.63, or approximately 105 000 lbs. per acre.

Thus, even excluding the humus below a depth of 3 feet, the arid soils of California contain more humus than the humid soils of America. The wonderful endurance of drought on the part of plants in Californian soils is due to this distribution of humus through a depth of many feet and the consequent deeper root penetration.

Professor Lipman has shown that nitrifying bacteria are present and active in Californian soils to a depth of six feet, and ammonifying bacteria are present through a depth of twelve feet, thus making available the nitrogen content of the humus to these depths.

Phosphoric acid is present in the humus of Californian soils to the extent of from 0.01 per cent. to 0.08 per cent. throughout the entire depth, though usually most abundant in the upper few feet.

600 - **Soils with a Mineral Acidity.** — LOEW, O. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 161-164. Berlin, 1914.

According to the writer, in considering soils with an acid reaction, a distinction is to be drawn between those in which this property is due to the presence of humus, and those which have a mineral acid reaction.

Soils with mineral acidity have recently formed a subject of research for agricultural chemists. Daikuhara, who was the first to turn his attention to this question, reported seven years ago that soils devoid of humus might have an acid reaction, and that this acid property was due to the clay. He also found that such soils exist, not only in Japan, but also in Corea and along the Chinese coast, countries in which the frequent summer rains may wash the basic elements out of the soil. Acid clays are also found fairly frequently in Germany and in the United States. According to Daikuhara these soils, when manured with neutral salts, as, for example, chloride of potash or sulphate of ammonia, become even less fertile than they would be without any manure, because the insoluble acids of the clay, uniting with the bases, liberate acids (in this case sulphuric and hydrochloric), and thus increase the acid nature of the soil. The writer concludes that acid soils should only be manured with basic fertilizers.

— **The Influence of Irrigation and Crop Production on Soil Nitrification.** —

MCBETH, I. G. and SMITH, N. R. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 40, No. 1-8, pp. 24-51. (article written in English). Jena, February 16, 1914.

These nitrification studies were carried out on the Greenville Farm adjoining to the Utah Agricultural Experiment Station. The soils are of sedimentary origin and contain no particles larger than "fine sand". Chemical analysis shows them to be exceptionally rich in the mineral nutrient constituents, but characteristically low in humus and possess only a fair nitrogen content. The surface soil to a depth of one foot contains 43 per cent. of calcium and magnesium carbonate in the ratio lime : 2.8 magnesia.

The influence of irrigation and growing crops on nitrification was determined by measuring the rate of nitrification of ammonium sulphate and dried blood when added to samples of the soils. Water from the Logan River was used for irrigation and was of fairly constant composition during the season. Analysis showed it to have a very low fertilising value and contain less than 400 parts of total residue per million.

The results obtained in these experiments are as follows :

- 1) The nitrifying power of the surface foot of soil was ten times that of the second foot and many more times that of the third, fourth, and fifth foot respectively.
- 2) Irrigation decreases the nitrifying power of soils, especially in the first two feet. This effect continues during the following season.
- 3) More than 50 per cent. of the full water capacity of the soil is required for maximum nitrification, but the quantity varies considerably in different soils. Maximum nitrification is generally secured when the soil is just on the point of becoming sticky. Too small a supply of moisture has a greater effect in retarding nitrate formation in these soils than a too liberal application.
- 4) The addition of a quantity of nitrogen as ammonium sulphate greater than 170 parts per million showed an inhibiting action on the nitrifying organisms. In no case was as much 50 per cent. of the nitrogen added as ammonium sulphate recovered in the form of nitrate.
- 5) Growing crops such as alfalfa, potatoes, oats and corn increase the nitrifying power of the soil, the effect being greatest in the case of alfalfa.
- 6) The greatest gain in nitric nitrogen was obtained from the alfalfa land when ammonium sulphate was used as the nitrifiable substance ; when dried blood was substituted for ammonium sulphate, the greatest gain was from the oats land.
- 7) The smallest gain with both ammonium sulphate and dried blood was obtained from the fallow land.

— **The Great Artesian Basin of Australia.** — *Journal of the Royal Society of Arts*, Vol. LXII, No. 3202, pp. 438-440. London, April 3, 1914.

The largest of all artesian basins is that in the eastern half of Australia, and it has been brought into prominence recently by the discovery of

a serious falling off in the supply. A Conference of the most eminent geologists and engineers from all the States was appointed with the object of discovering the cause, in view of arresting the decline in the output, and no report has been published. The basin in question is roughly triangular in shape, and about 1000 miles in maximum length from north to south and about the same from east to west. The intake surface beds which supply nearly all the water are on the eastern side of the basin, being in a more rainy country than on the west, and they coincide generally with the western slope of a belt of high country parallel to and about 200 miles from the coast. This belt is for the most part composed of porous Triassic freshwater sandstones. It has been estimated that 13 200 million gallons daily reach the stratum down to which bores are being driven, while about 700 million gallons are being drawn from the wells. As in most artesian basins, the bottom of the subterranean basin dips in some places and allows a certain amount of water to escape; in this particular case also, it has been ascertained that there is a considerable escape at the north end into the Gulf of Carpentaria.

The first discovery of artesian water was made in 1879; since then 84 000 square miles of country in New South Wales and 376 000 square miles in Queensland were found to be water bearing under natural pressure. Large areas of these tracts are within the 10-inch and the 20-inch average yearly rainfall, these amounts being also exceedingly irregular in incidence. Therefore as bore sinking advances vast pastoral districts in which millions of sheep died in drought times, are gradually being transformed into areas in which access to water is ensured, and great losses of stock are avoided.

According to latest returns 2 336 wells have been sunk, yielding, as said above, 700 million gallons daily. The maximum and minimum depths are 5045 feet and 5 feet, and the temperature of the water ranges from 148° F. to 70° F., increasing approximately 1° for every 44 feet.

The wells are almost exclusively used for watering stock, but in some places they have been used for township water supply and for the production of power, but not for irrigation, the quantities being generally too small. The recent Conference has advised prohibiting (with some exceptions) the employment of the water for any purpose other than that of watering stock.

The diminution in the supply had been noticed in a few cases since 1880 but about 10 years ago it became clear in many instances and since then it has become more or less marked over all the area of the great basin.

It was thought by some that local escape through defective casing of the bores or occasional drought over the intake beds might be the cause of the mischief, but the evidence before the Conference was not considered sufficient to confirm these opinions.

The Conference, in spite of the voluminous evidence collected, has not been able to come to any definite and complete conclusion as to the cause of the decline in the supply, and it has confined itself to recommending that more data be furnished to a Permanent Board sitting annually and that

**Progress in Irrigation in South Africa.** — *Daily Consular and Trade Report*, Year 17, No. 40, p. 786, Washington, February 27, 1914.

Under the system of irrigation boards, no fewer than 30 districts have proclaimed in the Cape Province alone, the capital expenditure involved being \$4 136 000; a number of Government irrigation settlements in the Cape, Transvaal and Orange Free State Provinces. Boring proceeding on nearly 500 farms and during the year ended March 31, 1913, 93 holes were completed having a total footage of 18 440 and a yield of 321 500 gallons per day.

The pumps most in use in South Africa are a reciprocating type suitable to varying capacities and heights and to installations where the water supply is irregular.

In regard to motive power for small pumping installations, oil engines of 6 HP are very commonly used. For larger installations suction gas engines are extensively employed, the most important to date being a 108 HP equipment at Grahamstown. In some districts anthracite coal is available and cheap to use, but suction gas plants are more widely in use and are already the accepted type for irrigation works of any size.

**Technical Precautions Necessary in the Electrification of Crops.** — PRIESTLEY, J. H. (Some recent experiments in the application of electricity to plant production), in *The Gardeners' Chronicle*, Vol. LV, No. 1424, pp. 245-247 and No. 1425, p. 271. London, April 18, 1914.

Previous experiments have been carried out in ignorance of the combination and sources of error attendant in the management of high potential charges. The technical difficulties to be overcome are:

1. Adequate insulation of the wires.
2. Changes in the area of distribution of the discharge by wind.
3. A simple and accurate method of determining the electrical condition of the atmosphere above each plot.

The changes in the direction of the discharge produced by changes in the intensity and direction of the wind will confuse the issue of all experiments, however carefully planned otherwise, if precautions are not taken to ensure normal electrical conditions for the control plots. The difficulties in controlling the electrical conditions without interfering with the other physical conditions of the plots are so great that it is necessary to make accurate records of the electrical condition of each plot throughout the experiments before the results can be interpreted satisfactorily. Further, comparisons of experiments made in different localities, or at different times, can be made, unless the particular electrical conditions prevailing at the time are considered.

Efficient insulators and a simple apparatus for the determination of the distribution of the electrical discharge have been devised. With an appreciation of the importance of these factors, the application of electricity to growing crops becomes a simple matter, and distinct improvement in the progress of this study is to be expected.

605 - **Production and Consumption of Fertilizers in the World.** — INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *Production et consommation des engrais chimiques dans le monde*. Second edition, pp. 162. Rome, 1914 (1).

The production, consumption and trade in fertilizers is of an eminently international character, as no country is in a position to provide for all its own wants in that respect; moreover, while the use of artificial manures is gradually spreading to all cultivated parts of the globe, the raw material from which they are produced is concentrated in only a few points. The present edition of the above publication has been completely revised with regard to the world movement of fertilizers by data for the countries which were not available in 1913.

*Production.*— The world's production of the principal fertilizers during 1910, 1911 and 1912 is given in Table I, together with similar data for 1903.

TABLE I. — *Total production of fertilizers (metric tons).*

	1903	1910	1911	1912
<i>Phosphoric manures.</i>				
Mineral phosphates . . . . .	3 098 866	5 609 760	6 181 199	6 852 311
Basic slag . . . . .	3 243 500	3 275 845	3 506 500	3 988 000
Superphosphate . . . . .	5 130 900	9 604 260	10 000 000	11 000 000
Guano . . . . .	71 100	61 000	83 000	720 000
Total . . . . .	10 544 366	18 550 865	19 770 699	21 912 311
<i>Potash manures.</i>				
Potash salts . . . . .	4 078 268	9 285 408	10 985 760	12 531 141
(containing $K_2O$ ) . . . . .	(366 421)	(857 883)	(939 927)	(1 009 211)
Indian saltpetre . . . . .	18 711	16 140	14 910	15 000
Others (given as $K_2O$ ) . . . . .	—	28 000—44 000		
<i>Nitrogenous manures.</i>				
Nitrate of soda . . . . .	1 485 279	2 465 415	2 522 120	2 586 111
Sulphate of ammonia . . . . .	582 206	1 053 994	1 198 363	1 327 111
Cyanamide . . . . .	—	30 000	52 000	95 000
Nitrate of lime . . . . .	25	25 000	50 000	75 000
Total . . . . .	2 607 510	3 574 409	3 822 483	4 083 211

The Seychelles have recently provided a new source of guano, producing 22 260 metric tons in 1911.

(1) Price 3.50 fr., to be obtained of the International Institute of Agriculture, Rome.

The figures for the total amount of phosphatic manures are too high, the mineral phosphates are counted twice over, being largely used in manufacture of superphosphate.

It is not possible to give exact figures for the total production of potash manures, but the great bulk of these is in the form of potash salts (sulfate). Modern developments in the production of potash manures consist in the extraction of potash; 1) from seaweed in the United States, which means it is estimated that an annual yield of 1 000 000 tons of potassium chloride (equivalent to 630 000 tons of  $K_2O$ ) might be obtained; 2) from the feldspars, also in the United States, by which means a possible annual yield of 400 000 tons of potash is estimated.

With regard to the nitrogenous fertilizers, the production of sulphate ammonia is five times as large as it was twenty years ago, and there has recently been introduced a new method of extracting it from peat; the process, known as the Mond-Frank-Caro process, extracts from 90 to 180 lbs. of sulphate of ammonia from one ton of peat. The production of synthetic nitrogenous fertilizers since 1903 is given below, together with estimated figures for 1913 and 1914 (in brackets).

	Calcium cyanamide metric tons	Nitrate of lime metric tons
1903 . . . . .	—	25
1904 . . . . .	—	550
1905 . . . . .	—	1 600
1906 . . . . .	500	1 600
1907 . . . . .	2 200	15 000
1908 . . . . .	8 300	15 000
1909 . . . . .	16 000	25 000
1910 . . . . .	30 000	25 000
1911 . . . . .	52 000	50 000
1912 . . . . .	95 000	75 000
1913 . . . . .	(97 000)	(140 000)
1914 . . . . .	(208 000)	—

Particulars as to the place of production of mineral phosphates, slag and sulphate of ammonia are as follows:

*Mineral phosphates.*

United States . . . . .	3 216 046 metric tons
Tunis . . . . .	1 923 000 "
Algeria . . . . .	388 515 "
France . . . . .	300 000 "
Christmas Island . . . . .	300 000 "
Ocean and Mauru Islands . . . . .	300 000 "
Belgium (excluding phosphatic chalk) . . . . .	203 100 "
Egypt . . . . .	69 958 "
Angaur (Palau Islands) . . . . .	50 000 "
Makatea (Society Islands) . . . . .	40 000 "
Dutch Antilles . . . . .	20 362 "

Russia . . . . .	25 000 metric tons
South Australia . . . . .	6 198 "
French Guinea . . . . .	7 230 "
Spain (1911) . . . . .	3 520 "
Japan, apatite (1911) . . . . .	2 271 "
Sweden (1907) . . . . .	5 317 "
Norway (1911) . . . . .	897 "
Canada . . . . .	164 "
<i>Basic slag.</i>	
Germany . . . . .	2 475 000 metric tons
France . . . . .	679 000 "
Belgium . . . . .	534 000 "
United Kingdom (1910) . . . . .	160 000 "
Austria-Hungary . . . . .	73 000 "
Others, including United Kingdom (1911) . . . . .	200 000 "
<i>Sulphate of ammonia.</i>	
Germany . . . . .	492 000 metric tons
United Kingdom . . . . .	394 521 "
United States . . . . .	149 700 "
France . . . . .	68 500 "
Belgium . . . . .	43 700 "
Holland . . . . .	6 000 "
Austria-Hungary . . . . .	34 550 "
Italy . . . . .	11 731 "
Spain . . . . .	12 000 "
Russia . . . . .	4 000 "
Japan . . . . .	4 000 "
Australia . . . . .	3 000 "
Denmark . . . . .	2 000 "
Sweden . . . . .	1 400 "
Others . . . . .	100 000 "

*Consumption.* — The world's consumption of the principal fertilizer during 1910, 1911 and 1912 is given in Table II.

TABLE II. — *World's consumption of fertilizers (metric tons).*

	1910	1911	1912
Mineral phosphates . . . . .	5 500 000	6 000 000	6 500 000
Superphosphates . . . . .	9 500 000	10 000 000	11 000 000
Basic slag . . . . .	3 000 000	3 330 000	3 500 000
Peruvian guano . . . . .	32 000	61 000	83 000
Potash salts . . . . .	4 039 622	4 353 000	4 520 000
(containing K <sub>2</sub> O) . . . . .	(766 200)	(848 705)	(904 000)
Nitrate of soda . . . . .	2 359 652	2 401 392	2 530 000
Sulphate of ammonia . . . . .	1 000 000	1 000 000	1 200 000
Synthetic nitrogenous manures . . . . .	50 000	75 000	150 000
	25 500 000	27 000 000	29 500 000

TABLE IV. — *Intensity of fertilizer consumption in different countries.*

Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption	Order of intensity
	quintals	hectares	qls. p. ha	
Germany .....	59 065 300	35 055 398	1.68	2
German colonies .....			undetermined	7
Argentine Republic .....	6 188	18 775 672	0.003	6
Austria .....	5 451 900	18 422 238	0.29	4
Hungary .....	2 293 100	22 182 718	0.10	4
Belgium .....	5 249 148	1 916 690	2.47	1
Brazil .....	85 219		undetermined	7
Bulgaria .....	3 680	4 840 760	0.0008	6
Chile .....	168 573	2 024 295	0.08	5
China .....	460 361		undetermined	7
Cuba .....	113 500	2 059 111	0.06	7
Costa-Rica .....	3 772	61 480	0.06	7
Denmark .....	1 639 157	2 890 784	0.57	3
Ottoman Empire .....			undetermined	7
Cyprus .....			id.	7
Egypt .....	559 620	3 326 755	0.21	4
El Salvador .....	26		undetermined	7
Spain .....	5 813 203	40 683 000	0.14	4
United States	Southern .....		0.87	3
	North Eastern .....		0.47	4
	Central .....		0.0264	5
	Western .....		0.0456	5
Philippine Is. ....	6 899		undetermined	7
Porto Rico .....			id.	7
Rance .....	21 161 656	36 798 715	0.58	3
Algeria .....	435 000	3 712 635	0.12	4
Tunis .....	165 900	1 570 000	0.10	4
Morocco and Indochina .....			undetermined	7
Other French colonies .....			id.	7
United Kingdom	Great Britain .....	10 160 000		
		13 120 000	18 198 590	0.70-0.92
	Ireland .....	2 300 000	6 997 736	0.44-0.50
Australia .....	2 650 000			
Canada .....	2 655 725	4 944 500	0.55	3
Ceylon and Straits Settlements .....	320 183	12 756 055	0.03	5
British India .....			undetermined	7
British India .....	18 647	90 269 783	0.0002	6
West Indies, British Guiana, Bermudes .....			undetermined	7
Mauritius .....	166 522	75 767	2.19	1
New Zealand .....	2 038 830	16 283 566	0.13	4
Union of South Africa .....	398 560	1 384 548	0.29	4
Greece .....	60 408	1 429 230	0.04	5
Guatemala .....			undetermined	7
Italy .....	11 910 950	20 772 892	0.57	3
Eritrea and Italian Somaliland .....				8
Lybia .....				8
Japan .....	3 707 459	7 694 892	0.48	4
Formosa .....		762 249	undetermined	7



Number	Country	Total consumption of fertilizers	Area of agricultural land	Intensity of consumption
		quintals	hectares	qts. p. ha
44	Luxemburg .....	312 000	154 832	2.02
45	Mexico .....	46 958		undetermined
46	Montenegro .....			
47	Nicaragua .....			undetermined
48	Norway .....	681 173	2 373 276	0.29
49	Paraguay .....			undetermined
50	Holland .....	4 259 220	2 177 642	1.96
51	Dutch East Indies .....	1 000 000	5 152 739	0.20
52	Guiana .....			undetermined
53	Antilles .....			<i>id.</i>
54	Peru .....			<i>id.</i>
55	Persia .....			
56	Portugal .....	1 528 147	5 037 665	0.36
57	Rumania .....	43 550	7 691 363	0.01
58	Russia .....	5 935 176	99 600 000	0.06
59	Finland .....		2 849 304	undetermined
60	Russia in Asia .....		25 218 627	<i>id.</i>
61	Salvador .....	31 620		<i>id.</i>
62	Servia .....	15 485	1 839 106	0.0084
63	Sweden .....	2 662 868	5 006 272	0.53
64	Switzerland .....	1 186 398	2 234 034	0.53
65	Uruguay .....	25 529	829 934	0.03
66	Bolivia .....			undetermined
67	Colombia .....			<i>id.</i>
68	Haiti .....			
69	Honduras .....			
70	San-Domingo .....			
71	Siain .....			
72	Venezuela .....			undetermined

As in Table I, the totals are again somewhat too high on account the mineral phosphates being employed in the manufacture of superphosphate. The value of the total consumption was below £ 80 mil in 1910 and above that figure in 1912.

Table III is a first attempt to determine the intensity of consumption of fertilizers in the different countries. The figures in the last column represent the order of intensity according to the following scheme:

Mean consumption of fertilizers in quintals per hectare of agricultural land

1	over 2	quintals ( 180 lbs. per acre)
2	1 to 2	" ( 90 to 180 " )
3	0.5 to 1	" ( 45 to 90 " )
4	0.1 to 0.5	" ( 9 to 45 " )
5	0.01 to 0.1	" ( 0.9 to 9 " )
6	less than 0.01	" ( 0.9 " )
7	undetermined	
8	no data	

An extensive bibliography is appended to the publication, which, in its present (second) edition, forms the starting point for the half-yearly review (*Revue semestrielle du mouvement international des engrais chimiques*). The publication of this Review was decided upon at the last General Assembly of the Institute (Inst. Int. d'Agr., 4<sup>th</sup> Ass. gén., Décis. II, Rapp. Roda-Laur, 1913) and the first number will appear on September 1, 1914.

1. **Five Years' Manuring Experiments in East Prussia.** — STUTZER, A. in *Arbeiten der Deutschen Landwirtschafts-Gesellschaft*, Part 258, 236 pp. Berlin, 1914.

The writer, with his collaborators, carried out in the five years 1909-1913, 66 field manuring experiments on 15 different estates, and 17 trials manures for meadows and pastures on several farms. The most important results obtained are the following.

1. *Potash.* — According to the literature on the subject, potash manures are credited with protecting winter cereals and other plants against frost, and this when the potash manures have been spread before sowing and the plants have taken up and elaborated the potash. According to the writer, it is very probable that the effect of potash manures in this action depends rather upon certain accessory circumstances than upon the plant-food potash itself.

In the experiments, the 40 per cent. potash salt proved better than nitrate as a winter top-dressing.

In sowing clover under spring grain (oats or barley), manuring with potash should not be neglected, as it is important for the cereal and still more so for the succeeding clover. In manuring experiments on permanent pastures and meadows, potash manures have proved especially necessary.

2. *Nitrogen.* — The experiments have confirmed the observation that dunged mangels which received nitrate of soda as well as potash and phosphoric acid made much better use of the potash in the manure and in the soil, and also of the nitrogen in the farmyard manure.

Further experience has been gained as to the good effects of the nitrate in nitrate of lime.

The effect of cyanamide in these experiments was considerably inferior to that of nitrate of soda or of nitrate of lime. The troublesome dust produced by cyanamide when broadcasted could be avoided by mixing with it 10 to 15 per cent. of iron pan. This also improves its action, as the presence of iron oxide assists in the transformation of cyanamide into urea. This mixture as a top-dressing for winter grain gave an increase in the yield and a better utilization of the nitrogen, viz. from 48 to 62, 29 to 59, 40 to 78, 49 to 87, 42 to 57 and 46 to 64 (as percentages) in the various experiments.

Cyanamide freed from carbide by treatment with steam gave a higher yield of grain than ordinary cyanamide in field trials with oats. The same result was obtained by adding organic substances to cyanamide.

Sulphate of ammonia obtained by Haber's process (combination of atmospheric nitrogen with hydrogen to form ammonia) proved equal in field trials to the product of coke and gas works.

The writer has also made observations on the action of a combined dressing of sulphate of ammonia and rock-salt on sugar beets in a very good year and a very bad year. In the good year this mixture gave decidedly better results than nitrate of soda; in the bad year the weather was very dry till the end of June and the beets developed very late: the result was that the amount of sugar produced on a given area was greater on the nitrate of soda plot.

Among new manures, urea obtained from atmospheric nitrogen and nitrate of urea, gave good results; their value was determined partly in field trials and partly in pot cultures. The urea used contained 43 to 44 per cent. of nitrogen, the nitrate of urea 33.60 per cent. In the pot cultures in the summer of 1913 oats were used; out of 100 parts of nitrogen supplied as manure, the following were recovered in the crop:

Manuring	Soil used	
	Loam	Peat soil
Nitrate of soda . . . . .	80.5	80.5
Urea . . . . .	83.5	88.5
Nitrate of urea . . . . .	94.5	77.0

In experiments with tobacco, nitrate of urea beat all other nitrogenous manures.

Three other compounds built up from atmospheric nitrogen, *viz.* calcium nitrite, aluminium-nitrogen and silicon-nitrogen, turned out to be of little value or quite useless.

In experiments on permanent pastures and meadows, small dressing of nitrogen have sometimes given highly satisfactory results; but it is not yet clear under what soil conditions such manuring is likely to be successful.

Stimulants (catalytic manures) have also been tried: mixtures of manures with various metallic oxides and salts of metals have sometimes given good results, sometimes none. It appears that different plants behave differently towards these bodies.

607 - **Comparative Effects of Nitrate of Soda and Nitrate of Lime** (1). — CHATEAUCLOS, J. in *Journal d'Agriculture pratique*, Year 78, No. 22, pp. 588-590. Paris, May 28, 1914.

Good results were obtained by using nitrate of lime on certain sandy and granitic soils poor in lime in the departments of Vienne and Haute Vienne.

608 - **The Manufacture of Calcium Cyanamide in Dalmatia** (1). — *Landes-Anzeiger* *blatt des Erzhertzogthums Osterreich u. d. Enns*, Year 10, No. 9, pp. 69-70. Vienna, 1914.

The manufacture of calcium cyanamide, which is making such great progress in all parts of the world (2) has of late become established also in

(1) Cf. article: "The Use of Artificial Nitrogenous Manures in Austria" by F. W. DAFFERT, in *B.* Dec. 1912, pp. 2547-2550.

(2) The estimated output of the world for 1913-1914 was 27 500 tons.

natia. The cyanamide factories which have been erected in that country re their power from the falls of the Kerka near Sebenico and of the Cetina Almissa, not far from Spalato. When completed, the factory at Al will produce about  $2\frac{1}{2}$  times as much as the one at Sebenico. The of the Cetina are not inconsiderable, and the driving power developed be force of the water is thus fairly high ; when the works are completed, e will be annually available about 80 000 HP.

**Austrian Experiments in Inoculating Leguminous Crops with Nodule Bacteria.** — KÖCK, G., in *Monatshefte für Landwirtschaft*, Year VII, Part 1 2, pp. 24-27. Vienna, January-February 1914.

The Vienna Phytopathological Station has carried out, on its exper- tal grounds in various parts of Austria, experiments in the inocula- of seed with nodule bacteria. The experiments were carried out with adella, beans, and lupins.

In one case serradella gave the greatest yield of green forage after treat- t with Azotogen (1) while in two others Nitragin (2) was the most effec- Azotogen having very little influence. In one experiment Nitragin

e a yield of green food  $2\frac{1}{2}$  times, and Azotogen twice, as large as that luced by the untreated area. The yield of seed was also, roughly speak- doubled by the use of either agent as compared with the untreated

. The nodule bacteria from the Institute of Agricultural Botany at pich also exercised a remarkably beneficial influence on the yield. No ence was observable, as a result of these experiments, from the inocula- on leguminous plants raised the following year on the same land.

With beans and blue lupins no noteworthy results were in either case e recorded, while in another experiment, part of the blue lupins shewed siderably increased yield. In this same experiment white lupins did respond at all to the application of various bacterial cultures.

It is, of course, impossible to generalize from the results obtained, with- taking into account the nature of the soil and of the plants grown. Trials his own land can alone afford the farmer conclusive information as to e economic value of this kind of treatment as applied to the various legu- is crops.

**Composition of Various Starches.** — TANRET, C. in *Comptes Rendus des Séances l'Académie des Sciences*, Vol. 158, No. 19, pp. 1353-1356. Paris, May 11, 1914.

The writer observed that all starches contain amylopectin and various oses in different proportions. They may also be distinguished from one er by the effect of water on the amylopectin and by the solubility e amyloses in hot water. Analytical methods are discussed and the com- on of various starches is given as follows :

1 Azotogen cultures supplied by HUMAN and TEISLER, of Dohna.

2 Nitragin cultures supplied by A. KÜHN's Agricultural Works, Bonn-on-Rhine.

*Amylopectin and amylose content of various starches.*

Starch	Amylopectin	Amylose	Starch	Amylopectin	Amylose
Oats . . . . .	71.5	28.5	Maize . . . . .	70	30
Banana . . . . .	79.5	20.5	Barley . . . . .	73	27
Wheat . . . . .	67.5	32.5	Peanut . . . . .	78.5	21.5
Chestnut . . . . .	67	33	Apple . . . . .	76	24
Broad beans . . . . .	72	28	Rice . . . . .	68.5	31.5
Horse beans . . . . .	76	24	Buckwheat . . . . .	78.5	21.5
Haricot beans . . . . .	75.5	24.5	Rye . . . . .	78.5	21.5
Lentil . . . . .	73.5	26.5	Potato . . . . .	73	27

- 611 - The Determination of the Quality of Starch in Rice Grains. - WARTH, I. and DARABSETT, D. B. -- 1. Disintegration of Rice Grains by means of Alkali, *Agricultural Research Institute, Pusa, Bulletin* No. 38, pp. 1-9, + plates I-VI.  
 2. The Fractional Liquefaction of Rice Starch, in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No. 5, pp. 135-146, + 1 plate, Calcutta, February 1914.

I. Chemical analysis reveals no differences in composition between different varieties of rice such as would account for their differences in hardness, milkiness, and milling qualities. With the object of devising some method of distinguishing the quality of the starch, rather than quantity, in different types of grain, these investigations on the disintegration of rice grains by means of alkali were commenced. Rice grains immersed in dilute solutions (one per cent.) of alkali show disintegration in a few hours owing to the solution of the protein constituent. At concentrations of alkali of 2 and 3 per cent. the starch granule is attacked and the whole of the grain becomes gelatinised. It was found that the degree of milling or polishing has no effect on the rate of disintegration, but that different varieties show considerable differences.

II. After a series of comparative trials, it was found that immersion in a 1 per cent. solution of potassium hydrate for 24 hours produced satisfactory results without causing appreciable breakage of the starch granules. Various samples of rice were disintegrated in this way, and, after neutralisation, were subjected to fractional liquefaction by conversion of the starch with malt extract at different temperatures. After conversion the solutions were filtered with kaolin to remove the unliquefied granules. The liquefied starch was estimated in an aliquot portion of the filtrate by hydrolysis with hydrochloric acid, the glucose content being determined by Fehling solution using permanganate for estimating the cuprous oxide. The quantities of permanganate required are proportional to the amount of starch liquefied at a given temperature, and may be used in comparing the qualities of the starch of the different varieties of grains.

The results obtained with various samples of rice are as follows:

- 1) Glutinous rices contain starch which liquefies appreciably at 60° C. and is almost completely liquefied at 70° C.
- 2) Hard vitreous rices do not begin to liquefy to any appreciable extent before 65° C. and reach completion at about 75° C. A sudden breakdown of starch takes place between 70° and 75° C.

3) In almost all types of rice there is a residue of 7 or 8 per cent. more resistant starch which only breaks down gradually. From these results it appears that the cooking quality of rice is distinctly related with its starch quality. Comparisons of the rate of disintegration in alkaline solution show that there exists some correlation between integration and starch quality. Further work is necessary to determine exact relationship between protein content, rate of disintegration starch quality.

- **The Movement of Potash in Plant Tissues.** — MAQUENNE, L. and DEMOUSSEY, E. in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 158, No. 20, pp. 1400-1404. Paris, May 18, 1914.

Branches of various plants were subjected to electrolysis in a jar containing distilled water in order to dissociate ionisable compounds. The anode liquid was then examined: more than four-fifths of its contents consisted of potash. The anode liquid on the other hand contained traces of phosphoric acid, and smaller traces still of sulphuric and hydrochloric acids.

- **The Action of Manganese on Plant Growth.** — 1. KELLEY, W. P. (The Function of Manganese in Plants) in *The Botanical Gazette*, Vol. LVII, No. 3, pp. 211-227. Chicago, March 1914. — 2. SKINNER, J. J. and SULLIVAN, M. X. (The Action of Manganese in Soils) in *Bulletin of the U. S. Department of Agriculture*, No. 42, Contribution from the Bureau of Soils. Washington, April 3, 1914.

Previous experiments on the effect of manganese on plant growth were very variable results. Two views have been put forward to account for the observed effects, viz. a) the stimulation of the activity of oxidising enzymes in soils and plant tissues; and b) the increased solubility of mineral constituents of soils. The inadequacy of these views to account for all the facts has led to the present investigations.

#### 1. — *The function of manganese in plants.*

The writer has studied the effect of manganese on plant tissues microscopically and chemically. He finds that changes take place in the protoplasmic contents of the cells of the roots and leaves. Occasionally protoplasm contracts from the cell walls and the nuclei become brown. In some plants (pineapple) the chlorophyll undergoes decomposition and starch formation ceases. This action is shown to be independent of the activity of the oxidising enzymes. The ash analyses of numerous plants show that manganese is absorbed in considerable quantities, that the ratio of lime to magnesia is increased and that the percentage of phosphoric acid is decreased.

From these results, the writer is led to suggest that manganese affects the permeability of the protoplasm to calcium and magnesium salts and that the consequent change in the rate of absorption of these salts may be beneficially or otherwise according as the ratio of lime to magnesia in the soil is less or greater than that required for maximum growth.

#### 2. — *The action of manganese in soils.*

Experiments were carried out to study the effect on growing crops of adding manganese salts to soils and to water cultures containing aqueous

extracts of soils. The effect in the oxidation of the soil of plots containing growing crops was also determined. The results obtained are summarised as follows:

a) Manganese chloride, sulphate, nitrate, carbonate and dioxide have a stimulating effect when applied to unproductive sandy loam soil. The best results were obtained when the salts were applied in amounts of from 5 to 50 parts of manganese per million.

b) On a productive loam the various salts of manganese had a stimulating effect.

c) The effect of manganese on the oxidising power of the roots is on the general growth of plants growing in aqueous extracts of soils varies with different soils. With poor, unproductive soils, especially those containing harmful organic compounds, the addition of manganese increased oxidation and growth. With productive soils, oxidation was increased but the growth was decreased, probably owing to excessive oxidation.

d) On soils of an acid nature the addition of manganese decreases the oxidising power of the soil and plants as well as the crop production.

e) The oxidising power of a soil depends not so much on the amount of manganese as on its form, and on the nature of the organic matter. Organic matter in a state of autooxidation increases the oxidising action of manganese.

The writers suggest that the beneficial action of manganese in certain soils may be due to its function of aiding and increasing the oxidation of other vital processes in the plant as well as in the soil, and by this means changing or destroying some noxious products detrimental to plant growth.

614 - **Action of Thorium on Seeds.** - MUÑOZ DEL CASTILLO, JOSÉ (Lecture before Spanish Farmers' Association) in *Boletín de la Asociación de Agricultores de España* No. 58, pp. 50-56. Madrid, March 1914.

Since 1912, the Radiological Institute of Madrid University has undertaken a series of investigations into the action of radium, thorium, and radioactive manures. By this means it has been confirmed that with regard to increasing the growing-power of seeds, the action of thorium is superior to that of radium as regards cereals and other food-plants, and that plants grown from seed subjected to thorium-radiation possess a stronger growth.

The most complete investigations were made with barley, the seed being placed in two earthenware pots filled with ordinary earth. In one of the pots small particles of thorium ore had been placed beforehand; the other pot acted as a control. From the seed produced by the pot containing the thorium, other cultures were started in two more pots, one filled with ordinary earth, and the other with similar earth containing thorium ore. The result, which the writer illustrates by means of photographs and a diagram, was as follows: the third generation of barley exposed to the action of the thorium had the leaves so highly developed that it looked like a new variety.

The writer observes that there are plenty of soils possessing radioactivity on account of thorium emanations, and that they ought to be used particularly for seed production. Analysis of soils to determine the presence of this property would therefore be useful.

- 5 - **Breeding Experiments which Show that Hybridisation and Mutation are Independent Phenomena.** — GATES, R. R. in *Zeitschrift für Induktive Abstammungs- und Vererbungslehre*, Vol. II, Part 4, pp. 209-278, + 25 figs. (article written in English). Berlin, March 1914.

Hybridisation experiments between *Oenothera rubricalyx* and *O. grandiflora* give results which cannot be interpreted in terms of Mendelian unit-characters. The red pigmentation characteristic of *rubricalyx* is dominant in  $F_1$  and shows segregation in  $F_2$ , but the ratios of pigmented and unpigmented offspring were different in different families. It is therefore concluded that different  $F_1$  individuals possess different degrees of prepotency as regards the percentage of pigmented plants in their offspring. Crossing back the  $F_1$  with either parent produced offspring of a darker or lighter shade respectively, showing that the amount of pigment produced by the individual cells is quantitatively inherited.

The characters for height were inherited according to the ratio tall : 1 dwarf in one family and 1 tall : 2 dwarf in another. When the reciprocal cross was made the ratio was 7 : 1. These results can only be accounted for by assuming different degrees of prepotency in different individuals.

The numerous differences in foliage, buds, pubescence and in physiological development between *grandiflora* and *rubricalyx* are non-Mendelian blending characters. In all these cases there is neither dominance nor segregation, but every conceivable degree of intermediacy is represented.

From these and other results the writer concludes that the Mendelian conception of fixed and unmodifiable unit characters which can be redistributed and shuffled regardless of the organisms themselves which exhibit these characters, is unsound, for the individual organism is the real unit. The presence-absence hypothesis implies a misconception of the nature of the differences between alternative characters, and of their interactions with each other.

Various mutants and aberrant forms occurred among the above hybrids. One of these, known as *lata rubricalyx*, was examined cytologically and was found to contain 15 instead of the usual 14 chromosomes. This work will be described elsewhere.

- 16 - **A Case of Correlation in Wheat.** — PARKER, W. H. in *Journal of Agricultural Science*, Vol. VI, Part II, pp. 179-181. Cambridge, May 1914.

In investigating the variation of the density of ear in a variety of wheat (Squarehead's Master) a striking case of correlation was observed between the average length of internode of the ear and its total length. The average internode-length is obtained by dividing the total length of rachis in millimetres by the total number of internodes. Measurements were made of the main tiller of 1887 plants and the calculated correlation coefficient



621 - **Manurial Experiments on Malting Barley carried out at the Vienna Experimental Station.** — DAFERT, F. W. in *Monatshfte für Landwirtschaft*, Year VI Nos. 1-2 and 3-4, pp. 5-19 and 50-58, Vienna, January-February and March-April 1902.

In 1906 manurial experiments were carried out with malting barley at the Vienna Experimental Station in order to determine the effect of application of phosphoric acid on the yield and quality of the grain. The experiments consisted of a series of 40 trials, in which plots were dressed with superphosphate at the rate of 180 lbs. per acre; all plots were duplicated. The average results were as follows:

Plot	Mean of 46 trials		Mean of 27 trials	
	Grain in lbs. p. acre	Increase due to manure, lbs. p. acre	Percentage of nitrogen in grain	Difference between manured and unmanured grain
Unmanured . . . . .	1 919	—	9.38	—
Superphosphate . . . . .	2 044	125	9.44	+ 0.06

The application of superphosphate produced no very marked influence on the yield, while the difference in nitrogen content between the manured and unmanured grain was less than that between the seed and the harvested grain, which was estimated in 28 trials and amounted to 0.61 per cent showing that climatic conditions are more important than manurial treatment with regard to the composition of the grain. When the barley obtained were grouped according to the phosphoric acid content of the soils in which they had been grown, the following results were obtained:

No. of trials	Percentage of phosphoric acid in soil	Increase in crop due to superphosphate lbs. per acre
5 . . . . .	over 0.2	145
9 . . . . .	0.15 to 0.2	123
21 . . . . .	under 0.15	79

These results are unexpected, inasmuch as the soils richest in phosphoric acid have apparently profited most by the dressing of superphosphate. Similar results have already been obtained in other places, but they cannot be considered as generally applicable.

622 - **Influence of Potash and Phosphoric Acid on the Quality of Malting Barley** — SCHÜLL, L., in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 5, pp. 641-7 Berlin, 1913 (Published January 15, 1914).

The experiments here described were made by the writer on the experimental ground of the Agricultural Institute at Giessen University in 1904. The soil is a fairly strong loam, is drained, and stands at 500 ft.; the average rainfall is 550 mm. (22 in.); the previous crop was winter wheat.

The subject of the experiment was a barley of the Imperial type, called New Burton Maltng. The barley was drilled in on the 10th of April, in rows 9 in. apart. On the 26th and 27th of April a mixed potassic and phosphatic dressing was applied. To ascertain whether the substances under investigation were present in the minimum amounts required by the crop they were applied in three progressively increasing quantities:

	40 per cent potash salts	Superphosphate (18% water-soluble phosphoric acid).
	cwt. per acre	cwt. per acre
Light dressing . . . . .	0.4	0.8
Medium " . . . . .	0.8	1.6
Heavy " . . . . .	1.6	3.2

By combining the above quantities, fifteen different dressings were obtained.

- 3 potash alone: light, medium, and heavy.
- 3 phosphates alone: " " "
- 3 combining a light potash dressing with each of the 3 strengths of phosphates
- 3 " " medium " " " " " " " " "
- 3 " " heavy " " " " " " " " "

In addition, there were 5 plots with no manure, and the whole was run in duplicate, making a total of 40 plots, each measuring 12 sq. yds. To ensure the action of the potash and of the phosphoric acid, a dressing of 2.4 cwt. of nitrate of soda was applied to the manured plots on the 30th of April. All the manures were hoed in and the plots raked over. The whole experimental area had been limed with 16 cwt. per acre of 96 per cent ground quicklime.

The weather began by being cool in April, was finer and warmer in May, then became cool and wet for the first three weeks of June, but the temperature reached summer level for the last ten days; July, however, was cool and rainy, and heavy rain at the end of the month lodged some of the barley. The crop was harvested dead-ripe on the 14th of August. No definite statement can be made as to any difference in the ripeness of the various plots, but the results of analysis seem to point to there having been such a variation.

The corn was threshed and the yield ascertained on the 18th and 19th of August. The judging of the quality, which was not carried out till June 1910, had reference to: protein and water content, weight of grain, evenness of the sample, fineness of the husk, colour, germinating capacity and energy, impurities, damaged grain, sprouted grain, foul odour.

The writer obtained the following results:

1. In every case the soil profited by a phosphatic dressing, which caused a fuller utilization of nitrogen and potash. A quite remarkable demand for potash was observed to be brought about by the medium and strong dressings of phosphates.

2. The potash-phosphate dressings always effected an increase in the gross yield.

3. The use of 40 per cent. potash salts and of superphosphates as a top-dressing proved suitable.

4. The protein-content, which was very high on account of the nitrogenous dressing, was decreased by the application of combined potash and phosphates and this decrease corresponded to the increase in the yield.

5. The proportion of dry matter shows a nearly regular increase with the use of combined potash and phosphates, independently of the yield. It was not possible to find out whether this is due solely to a more advanced stage of ripeness, owing to the better nourishment of the barley, or to a larger deposit of potash and of phosphoric acid in the grain. In cases where no increase in yield was found on plots with heavy potash dressings and phosphoric acid, as compared with those with moderate potash dressings, a superfluous consumption of potash is to be assumed.

6. Not regularly, but still in the majority of cases, the double dressing gives an increase in 1000-grains weight and in the size of the grains, and a decrease in the proportion of husk.

7. Increase of the 1000-grains weight is generally accompanied by increase in the number of grains which will not pass through a 2.8 and a 2.5 mm. sieve. The weight of husk varies inversely.

8. Combined potash and phosphate manuring improves appreciably the germinating capacity and more still the germination energy.

9. Barley dressed with potash and phosphoric acid has nearly always a canary-yellow colour.

The writer concludes that in order to obtain a high-class sample, nitrogen should be present in as small a proportion as possible. If a maximum yield and the highest quality are incompatible, it is none the less possible, up to certain point, to obtain by means of a nitrogenous manuring an increase in yield without injuring the quality. The attainment of this point depends essentially on the quantity of potash and phosphoric acid employed. In discussing his results the writer quotes those obtained by several other investigators.

623 - Argentine Lucerne Seed. — Dirección General de Agricultura y Defensa Agrícola. Boletín del Ministerio de Agricultura, Vol. XVII, No. 1, pp. 82-89 + 3 coloured plates. Buenos Aires, 1914.

At the present time, Argentina produces all the seed necessary for her great crops of lucerne, and will be able, at no distant date, to become an exporter. The quality, however, does not correspond to the increase in quantity, since the seed leaves a great deal to be desired in the way of purity, absence of dodder and germinating capacity. But on the other hand the native seed gives more hardy and lasting plants than any imported variety.

The seed from the irrigated districts of Mendoza, San Juan, La Rioja, part of San Luis, north of Córdoba, Salta, Jujuy and Catamarca, generally contains a large amount of dodder (*Cuscuta corymbosa* R. et P. and a variety of *C. racemosa* Mart.) and seeds of *Melilotus parviflorus* Desf., and sometimes

a large quantity of *Lippia nodiflora* Rich., *Schkuhria bonariensis* Hook., *Bidens leucanthus* Wold., *B. scabiosoides* H. et Arn., *Panicum colonum* L., *Chenopodium opolifolium* Schr., *Madiola latoritza* Schm., *M. malvifolia* Gr., *Anoda triangularis* Db., and *Sida rhombifolia* L. The seeds of this last species constitute, together with those of dodder and melilot, a real menace to farming. *Sida*, being perennial, is difficult to destroy.

Another serious drawback to native seeds is the presence of hard grains, 50 per cent on an average, only half of which are capable of germinating, the other half being pure loss.

In a second area, comprising the south of Córdoba, part of San Luis, the north of the Pampa, the west and north-west of Buenos-Aires and the department of San Rafael de Mendoza, the seeds of lucerne are less well developed, and in some cases, as at San Luis, very small indeed, although well shaped. In this area there is less dodder, but there are usually several other extraneous seeds: *Chenopodium*, *Amaranthus*, *Cnicus*, *Centaurea*, *Trihemis*, *Plantago*, *Rumex*, etc. Hard seeds occur in a proportion of 25 per cent. The germinating capacity is undoubtedly superior and the plants produced last a long time and resist drought well.

To the third area belong the south of Buenos-Aires, Rio-Negro and Chubut. The seeds from there are fairly popular, both on account of their size and on account of the small quantity of extraneous seeds present. There are, however, 50 per cent. of hard seeds in the two latter provinces, and 30 per cent. in that of Buenos Aires. Dodder is not often found.

To sum up, it may be said that Argentine lucerne seed grown without irrigation surpasses in germinating capacity all the foreign varieties of lucerne, but that it has nevertheless the following faults:

1. It is impossible to obtain large quantities of good seed of even quality.

2. A large proportion of the native seed is so impure that diligent cleaning would be required before it could be sown; but this cleaning cannot be effected, owing to the small difference in price between good and bad seed, and because purchasers prefer a low price without troubling about quality.

3. A large quantity is found of the seeds of *Cuscuta racemosa* Mart., and of *C. corymbosa* R. and P., the size of which makes it impossible to separate them from the lucerne seed.

4. A large quantity of hard seeds are present; these cause a considerable reduction in the germinating capacity and energy.

To obviate these faults, it would be necessary: 1) for the producers to eradicate weeds in the lucerne fields, abandoning those fields which cannot be cleaned; 2) for the purchasers to pay attention to buying good, well-cleaned samples of seed instead of seeds offered at a low price.

<sup>24</sup> - Determination of Certain Species of *Carex* by their Vegetative Characters. — KOSNEZOV, W. in *Bulletin für angewandte Botanik*, Year 7, No. 1 (65), pp. 18-41 + 10 plates. St. Petersburg, January 1914.

The writer has prepared the following schemes for the determination of species of *Carex*.

*A. Determination of the ten chief species of Carex growing in swamp meadows by field examination of the vegetative parts.*

1. The plants form dense or more or less open clumps . . . . .
- Plants with creeping stems, not forming clumps . . . . . *C. acuta* L.
2. Very open clumps, not forming tussocks. . . . .
- Dense clumps, forming more or less well-developed tussocks . . . . . *C. paludosa* Good
3. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network . . . . .
- Membrane of the leaf-sheath veinless, not wearing to a network . . . . . *C. stricta* Good
4. Membrane of the leaf-sheath veined, wearing to a delicate filamentous network . . . . .
- Membrane of the leaf-sheath veinless, not wearing to a network . . . . .
5. Cross-section of upper part of leaf-blade showing reflexed margins . . . . . *C. vulgaris* Fries
- Cross-section of upper part of leaf-blade semicircular or channeled without reflexed margins . . . . . *C. paradoxa* Willd
6. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . . . .
- All three sides of the leaf-sheath thick, foliaceous, green . . . . . *C. disticha* Huib
7. Membrane of the leaf-sheath veined, wearing to a filamentous network . . . . .
- Membrane of the leaf-sheath veinless, not wearing to a network . . . . .
8. Leaves soft, whitish within . . . . . *C. ampullacea* Good
- Leaves rigid, bright green within . . . . . *C. vesicaria* L.
9. Plant greyish-green or bluish-green . . . . . *C. panicea* L.
- Plant green or yellowish-green . . . . . *C. teretiuscula* Good

*B. Determination of the ten chief species of Carex growing in swamp meadows by examination of the vegetative parts in hay.*

1. One side of the leaf-sheath forming a thin, semitransparent, whitish membrane . . . . .
- All the sides of the leaf-sheath thick, foliaceous, green . . . . . *C. disticha* Huib
2. Membrane of the leaf sheath veined, wearing to a filamentous network . . . . .
- Membrane of the leaf-sheath veinless, not wearing to a network . . . . .
3. Leaf-blade soft, whitish within . . . . . *C. ampullacea* Good
- Leaf-blade stiff, green or greyish-green within . . . . .
4. Leaf-blade bluish-green below . . . . . *C. paludosa* Good
- Leaf-blade greyish-green or light green below . . . . .
5. Leaf-sheath tinged with reddish . . . . . *C. vesicaria* L.
- Leaf-sheath light or dark brown . . . . . *C. stricta* Good
6. Cross-section of leaf-blade channeled, the central and upper parts with reflexed margins . . . . .
- Cross-section of leaf-blade channeled or semicircular, without reflexed margins . . . . .
7. Leaf-blade bluish-grey-green or bluish-grey . . . . . *C. panicea* L.
- Leaf-blade green, greyish-green or yellowish-green, not blue grey . . . . .
8. Upper part of leaf-blade with slightly reflexed margins . . . . . *C. acuta* L.
- Upper part of leaf-blade with strongly reflexed margins. . . . . *C. vulgaris* Fries
9. Ligule continuous with the top of the leaf-sheath membrane, the two forming a collar round the stem or the shoot . . . . . *C. teretiuscula* Good
- Ligule distinct from the leaf-sheath membrane, not forming a collar . . . . . *C. paradoxa* Willd

**Large Scale Field Trials with Mangels.** — VON RÜMKE, K., and ALEXANDROVICH, J., in *Landwirtschaftliche Jahrbücher*, Vol. XLV, Part 4, pp. 503-596 + 6 figs. Berlin, December 23, 1913.

In 1912 the writers carried out field trials on a large scale in collaboration with R. Leidner, K. Schröter and O. Bormann, with 35 different varieties of mangels. Six plots were devoted to each variety and the seed drilled in. The yield, percentage of dry matter, and sugar-content were ascertained, and a description of the quality and quantity was given in the report. In working out the results, experimental errors were reduced by algebraic compensation.

On completion of the experiments, the writers make suggestions for profitable carrying out of large scale field trials. The object of the investigations is to classify more exactly, according to quality and quantity, numerous varieties on the market. The more direct testing of each individual variety composing a group which the large scale field trials point to as suitable for certain conditions, must be left to the future. Trials covering one year only, but embracing a wide variety of soils and climates, carried out in different districts and repeated periodically, are more satisfactory than large scale trials lasting over several years in the same district, especially on account of the greater rapidity with which information can be obtained by the former method.

**Studies in Indian Cottons. Part I: the Vegetative Characters.** — LEAKE, H. MARTIN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VI, No. 4, pp. 115-157, + 3 maps + 9 plates. Calcutta, February 1914.

Studies of the vegetative characters of Indian Cottons have been in progress in the United Provinces since 1905.

As a result of these and other studies of various herbarium collections the writer classifies the various types as follows.

#### MONOPODIAL.

Perennial; secondary branches ascending sharply at an acute angle. Leaf factor (1) less than 2; plant almost glabrous. Bracteoles small, ovate; margin entire or dentate. Corolla yellow.

*Gossypium obtusifolium* (Roxburgh *Flora Indica*) Gammie and . . . . . Type 1.

Perennial; secondary branches spreading. Leaf factor less than 2; stem and leaves densely covered with short hairs. Bracteoles deeply lobed or reniform, deeply serrate, spreading in fruit. Corolla yellow, lobes small. Stigma heavily glandular. Capsule inflated and nearly spherical with a sharp mucronate apex.

*G. herbaceum* (Linn.) Todaro and Gammie, and *G. obtusifolium* var. *indiana* Watt . . . . . Type 2.

(1) It may be defined as the ratio of the length of the middle lobe to its greatest width. For explanation see *Journal of Genetics*, Vol. I, No. 3, pp. 220. (Ed.).

Perennial "tree cotton"; secondary branches ascending sharply at an acute angle. Entire plant deep red or purple. Leaf factor greater than 3; frequently an extra tooth on one or both sides of the central lobe. Bracteoles small, triangular; margins entire or with the tip dentate. Corolla deep red. Stigma eglandular. Capsule usually 3-celled, ovate. *G. arboreum* (Linn. sp. Pl.) Parlatore and Todaro, and *G. arborea* Gammie and Watt . . . . . Type 3

Plant tall with long monopodial branches sharply ascending. Leaf factor greater than 3; leaf wrinkled. Leaf and stem covered with short hairs. Bracteoles triangular with margin dentate. Flowers yellow or white.

The commonest form of this group possesses the habit and shape of bracts of Type 3, with the wrinkled leaf and short hairs of Type 2. It comprises the *G. intermedium* of Gammie.

#### SYMPODIAL.

Annuals with few or none of the lowest secondary branches monopodial; the remainder sympodial; monopodial branches ascending and sympodial spreading.

Plant tall, drooping later under the weight of fruit. Leaf large, factor less than 2; lobes 3 or with 2 small accessory basal lobes. Young stem and leaves sparsely hairy. Bracteoles small, entire or with few small apical teeth, closely enveloping bud and fruit. Corolla yellow with deep red "eye". Petals large, semi-transparent. Stigma eglandular or with few glands only. Capsule 3-celled ovate.

*G. indicum* (Lamk.) Gammie, and *G. Nanking* var. *bani* Watt. Type 3

Plant erect, drooping later. Leaf factor less than 2; lobes 3. Young stem and leaves hairy. Bracteoles large, entire or with a few small apical teeth, loosely enveloping bud and in fruit sometimes reflex. Corolla yellow with deep red "eye"; petals opaque. Stigma eglandular or with few glands only. Capsule 3-4 celled, ovate. . . . . Type 3

Plant erect,\* differing from Type 4 in greater rigidity of main stem and greater angle at which secondary monopodia arise (about 45°), as in the white corolla. Petals small, scarcely projecting beyond the bracteoles . . . . . Type 3

Plant erect, secondary branching monopodial, when developed, sharply ascending. Leaf factor less than 2; flower white. The plant is strongly asymmetrical and the vegetative period very brief, the first flowers developing while the plant is quite small. Growth continues throughout the season the plant maintaining a marvellous fertility. . . . . Type 3

Plant tall, drooping later. Leaf factor greater than 3; lobes 3 with an extra tooth on one or both sides of the central lobe frequently developed. Young stem and leaves hairy. Bracteoles entire or with few apical teeth. Corolla yellow with deep red "eye". Stigma eglandular or with few glands only. Capsule 3-4 celled, ovate. . . . . Type 3

Plant differing from above only in the colour of corolla which is white scarcely protrudes beyond the bracteoles . . . . . Type 9.

Types 4-9 belong to the *G. neglectum* and *G. roseum* of Todaro, the *neglectum* (Tod.) of Gammie and the *G. arboreum* vars. *neglecta* and *rosea* Watt.

Plant tall with main stem weak and early drooping. Leaf factor greater than 3; lobes 5-7. Bracteoles entire or with few apical teeth, large continuing to grow with the developing boll. Corolla pale yellow with deep "eye". Stigma eglandular. Capsule ovate, very large with numerous seeds. *G. cernuum* of Todaro and Gammie and *G. arboreum* var. *assamica* Watt. . . . . Type 10.

Plant tall. Leaf factor greater than 3; lobes 5-7; stem and leaves deep red or purple colour; bracteoles entire or with few apical teeth. Corolla with deep red "eye"; petals white, tinged with pink along margin the portious exposed in the bud.

*G. sanguineum* Hassk. var. *minor* Gammie . . . . . Type 11.

Plant small, with monopodial secondary branches few or none. Leaf factor less than 2; lobes 3-5. Flower yellow. Boll large. Includes types in China.

Corolla yellow-eyed; seed with fuzz . . . . . Type 12.

" " " " naked . . . . . Type 13.

" without eye; seed naked . . . . . Type 14.

Plant differing from Type 2 in the character of the secondary branches. This group includes a complex series of forms from Persia. The simplest is the true *G. herbaceum*, Todaro.

*G. hirsutum* Linn. This plant, which yields the bulk of the American cotton crop, has formed the basis of numerous experiments in India.

*G. Stocksii* Max. Mast. A wild form of *Gossypium* found on the limestone hills around Karachi.

**Pollination.**—The cotton flower is hermaphrodite and self-fertilisation is effective in almost every case. Experiments in cross-fertilisation show that the different forms of *Gossypium* fall into two marked groups, the members of which are fertile *inter se* but completely sterile between the two groups. These groups are characteristic of the Old and New World and are respectively characterised by united and free stamens.

**The colour of the corolla.**—The colour of the petals may be yellow, white or red. The latter colour is only found in Types 3 and 11 and extends to the sap. Two forms of yellow are readily distinguished, *viz.* 'yellow' and 'pale-yellow'.

Breeding experiments show that yellow is dominant both to pale-yellow and to white. The inheritance of the pale-yellow factor is under further investigation.

**The 'eye' of the petal.**—All true Indian cottons possess an eye situated at the base of the petal. In some Chinese forms the petal is self-coloured



yellow, and crosses between these forms appear to show that the 'eye' factor is dominant, though in one case an intermediate form of eye appeared and has bred true to this condition. This constitutes, therefore, a further type.

*The red colouring matter in the sap.* — The presence of red colouring matter in the sap entirely masks the true petal colour. The true petal colour can only be directly determined in cases of diseased flowers or sap as open out of season. The factor for red-coloured sap appears to be dominant over its absence, though the intensity of the colour is diminished and the petals attain a condition known as 'red on yellow' when the cross is made with a yellow-flowered plant.

*The type of branching and the length of the vegetative period.* — The axil of the leaf of the cotton plant contains two buds, one main bud to which the second is accessory. Vegetative growth is effected by the development of a monopodium from either of these buds, reproductive growth only by the development of a sympodium from the former. Therefore according as the main bud develops into a sympodium or a monopodium, so will the appearance of the first flowers be accelerated or retarded in other words the length of the vegetative period is controlled by the form of the secondary branches. In pure monopodial types even the ultimate secondary branches are monopodial. In sympodial types generally a few of the lowest secondary branches are monopodial. In hybrids between these forms every gradation is found and the change from the sympodial secondary branching to the lower monopodial branching is so abrupt that the character can be conveniently expressed as the percentage of the stem bearing monopodial branches. In actual practice, however, growth does not continue sufficiently long to enable this character to be determined accurately. The length of the vegetative period is therefore made use of in this connection. Determination of the correlation coefficient between the type of branching and the vegetative period gave 0.6628 and 0.85 for different series.

Crosses between sympodial and monopodial types give  $F_1$  generation with a vegetative period intermediate between those of the two parent types and approximating in a greater or less degree to that of the sympodial parent. The  $F_2$  generation form a continuous series showing every degree of length of vegetative period, but, though the full sympodial type appears comparatively frequently, the full monopodial type only rarely ever does so. In the  $F_3$  generation the average length of the vegetative period of a family approximates to that of the  $F_2$  parents.

*Conclusions.* — Up to the present these studies have been confined to factors of considerable, though only indirect, importance. The more intricate task of studying the commercially valuable portion of the crop is the subject of further investigations.

**Oils in the Seeds of *Dumoria Heckeli* and *Baillonella toxisperma***

Pierre. — DE WILDEMAN, E. in *Bulletin de l'Association des Planteurs de Caoutchouc*, Vol. VI, No. 4, pp. 81-83. Antwerp, May 1914.

*Dumoria Heckeli* (1), found on the Ivory Coast by CHEVALIER is native tropical virgin forests. Its seeds yield a semi-solid oil, snow white when fresh, with a pleasant sweet flavour and slightly aromatic, at the rate of 16.5 per cent. of the seeds or 33.25 per cent. of the kernels.

*Baillonella toxisperma* Pierre, or *Minusops Djawa* Engler, has been recently found in the Mayumbe district of the Belgian Congo. It yields white aromatic oil at the rate of 56.04 per cent. of the kernels or 40.60 per cent. of the seeds.

Both residual cakes are unfortunately toxic on account of the presence of a glucoside of the saponin group, but they may be employed as manure, as they contain a considerable amount of potash and nitrogen (2 and 3 per cent. respectively) though very little phosphoric acid (*Dumoria Heckeli* 76 per cent.).

8 — **The Improvement of Indigo in Bihar.** — HOWARD, A. and HOWARD, G. L. C. in *Bihar Planters' Association Bulletin*. Calcutta, 1914.

The cultivation of Java Indigo (*Indigofera arrecta* Hochst.) in Bihar is rapidly declined since 1910, owing to the increasing prevalence of a so-called disease which prevents seed formation. The disease appears towards the end of the monsoon and is characterised by a great reduction of leaf surface and a change in the colour of the remaining leaves to a yellowish green slaty colour. Cultivation experiments have shown that this diseased condition of the plant is due to long continued wetness of the soil, which leads to the destruction of the young feeding roots, followed by leaf fall and more or less complete wilting of the plant.

This wilting can be checked for a time if the plants are only pruned at the first cut, leaving one branch, instead of being completely cut back. The process is more conducive to normal growth and results in an increase in the total crop.

After the second cut in an ordinary monsoon the crop ceases to be profitable and should be dug up to make room for *rabi* crops.

The growth of indigo for leaf and for seed should be regarded as separate things and seed should not be raised from the old plants which have been cut for leaf. The best method of obtaining good seed of Java Indigo is to sow the crop in lines about 24 inches apart in the middle of August in high-lying, well drained fields which are in good heart. After gathering the seed the crop can be grown on for leaf during the next monsoon. Being a deep rooting plant, the surface soil may be harrowed and the weeds destroyed with great benefit to the plant. When wheat is grown as a winter crop an early maturing variety with little foliage and stout straw gives the best results.

**Selection.** — Owing to the frequency of cross-pollination the ordinary-

(1) See FOURNIER, J. *Etude pharmacologique des graines du Dumoria Heckeli et du Baillonella toxisperma* Pierre. Clermont Ferrand.

methods of single plant selection cannot be applied to this crop. Further the method of estimating the indican-content is too difficult and expensive to be employed in selection experiments. Selection must therefore be confined to those individuals in the mixed crop which grow rapidly and strongly and which by their habit of growth and amount of leaf surface are likely to give the highest yields of leaf. A process of roguing will be necessary to remove all undesirable types and prevent their crossing with the better types. Similar methods require to be applied to the ordinary Bihar indigo (*I. sumatrana*), and a reliable system of seed distribution remains to be established.

629. — **Hevea in Cochinchina.** — GIRARD, M. E. in *Bulldin Economique de l'Indochine*, Year XVII, No. 106, pp. 46-53. Hanoi, January-February 1914.

*Effect of the dry season on Hevea plantations.* — The dry season is in no way unfavourable to the growth of hevea in the deep soils of Cochinchina; more especially if the soil surface is kept stirred during the wet season so that the rainfall is absorbed. In one year in which the dry season extended over five or six months, the average circumference of trees increased 4 to 6 in. in certain groups, while individual increases amounted to as much as 7 in. The dry season is moreover eminently useful in checking the development of fungoid diseases, especially *Fomes semitostus*.

Contrary to results obtained elsewhere, the dry season apparently has a very favourable effect on the yield of latex. During November, December and January the highest yields are obtained, reaching in the latter month as much as 50 per cent. more than the average for the rainy season. When vegetation becomes active again the yield decreases rapidly and tapping is suspended.

Tapping lasts about 300 days, during 180 to 200 of which the yield is approximately equal to that obtained in the Malay States, whilst during the 100 to 120 days at the height of the dry season the yield is considerably higher.

*Capacity of Annamite labour.* — The skill and rate of working of the tappers gradually improved, so that the number of trees tapped per man rose from 125 to 400 per day. Further, each man, besides making the excisions on every tree, wetted the cuts, collected the latex and the scraper carried the latex to the factory and cleaned all recipients employed. When the price of rubber went down, the process was simplified by suppressing the use of water on the cuts, with the result that each man was able to undertake 600 trees and each woman 450 trees per day; these figures represent averages for all the coolies over a period of several months and are important, as three-quarters of the expenses of production are represented by the cost of tapping. The writer considers that the suppression of watering will not only economise labour, but also prove beneficial by causing the latex to be less diluted and the rubber of better quality.

*Advantages of smaller excisions.* — After numerous experiments, the method of practising three excisions, 18 in. apart vertically, and only engaging one-fifth of the circumference of the tree, has been adopted, as the long

it gives the wound a better chance of healing, while the yield is increased at any rate in no way decreased by limiting the tapping area.

- **Influence of the Partial Removal of the Bark on the Yield of Latex in *Manihot Glaziovii*** (1). — ZIMMERMANN, A. in *Der Pflanser*, Year X, No. 4, pp. 180-188. Daressalam, April 1914.

Experiments carried out at Amani and Victoria have shown that the partial or total removal of the bark of *Manihot Glaziovii* increases the production of latex. Of the two methods, the partial removal is more to be recommended, not only because it has a better effect on the yield of latex, but also because it requires less labour and is less liable to damage the tree.

- **The Industrial Uses of Maize when Cultivated for Sugar.** — BOYER, L. in *La Sucrierie Indigène et Coloniale*, Year 40, Nos. 10, 11, 13, 17, pp. 226, 253, 299, 343, 392. Paris, March 11 to April 29, 1914 (2).

After a short account of the history of the subject, the influence of nutrition on the sugar content of maize juice is discussed. Of all known varieties the Giant Servian is the one which has the richest juice in sugars, and JUMELLE has also reported a variety from the Ivory Coast which yielded, in male castration alone, a juice containing 10.49 per cent. of saccharose and 1.23 per cent. of glucose, whilst the male castrated Servian variety yielded 9.68 per cent. of saccharose and 1.32 per cent. of glucose.

The production of sugar from the juice has still to overcome certain technical difficulties. The ordinary process of extraction in use in sugar factories only results in about half the saccharose being obtained in the form of crystallised sugar from a juice of 59 per cent. purity. The residual molasses contain a high percentage of glucose and are approximately the same quality as molasses from refineries; they could be profitably utilised by working them up with the fibrous residues into stock food at the sugar factory itself, the food value of such a product being estimated on the basis of food values in straw. Or a still better use might be to reduce the stalks to a fine meal after a preliminary drying, and put the product on the market either in the pure condition or mixed with various other materials to increase its nitrogenous content and make it into a better balanced food. As the maize would be harvested during the warmest season of the year the stripped stalks could quite well be set up in sheaves to dry, so that their water content should be reduced to 15 to 20 per cent.

As raw material for the manufacture of denatured alcohol, maize is superior to beets both with regard to the produce obtained per ton of raw material substance and to the possible profits. In comparing Giant Servian maize with beets of a corresponding sugar content, the value of the maize works out at 3s 9d per ton more than that of the beets; moreover the distillery residues of maize can be sold to paper works at 3s 6d per ton, while the beet pulp is only worth 2s 6d per ton.

(1) See ZIMMERMANN A., *Der Manihot-Kautschuk*, p. 176.

(2) See No. 512, B. May 1913.

- 632 - **Comparative Water Absorption of Sugar Cane Plants when Suffering from Sereh Disease** (1) — BREMEKAMP, C. E. B. (Paseroean Experimental Station). *Archief voor Suikerindustrie in Nederlandsch-Indië*, No. 14, pp. 514-519. Sourabaya, April 1914.

The vascular system of sugar cane plants suffering from sereh is stopped up with gummy matter which influences the circulation of water in the plant so that healthy stems absorb 1.18 times more water than affected stems. Using a lithium salt as an indicator, the writer showed that the salt had risen to a height of 70 cm. in 3 ½ hours in a healthy plant, while in a diseased plant it had only reached 30 cm.

- 633 - **Coffee in Tonking.** — BOREL, M. in *Bulletin Economique de l'Indochine*, Year XVI, No. 106, pp. 54-60. Hanoi, January-February 1914.

The coffee bush is little pruned in Tonking owing to the borer (*Xylotrechus quadripes*), which causes so much damage on plantations the planters allow suckers to grow in order to furnish a substitute for the parent bush when the latter is attacked by the beetle. On the other hand the bushes are kept low by being topped as soon as they are one year old in order to develop the lower branches and expose the young plant less to the action of the wind. Usually the trunk is not allowed to grow above 5 ft. making with the uppermost branches a total height of 6 to 6 ½ ft. which could not be increased without letting some of the fruit get out of reach of the pickers.

Manurial requirements per bush are : 55 lbs. of dung every two years ¾ oz. of nitrogen, 1 oz. phosphoric acid and 2 ½ oz. of potash every year and every three years a dressing of lime varying in amount with the nature of the soil.

The yield per bush varies from ½ lb. to 2 lbs. of coffee, with an average of about 1 lb. Approximate estimates of expenses and returns on coffee plantations are as follows:

*A. Plantation of 50 000 bushes.*

	£
Total cost of establishing plantation spread over 4 years . .	4 310
Expenses during 5th year . . . . .	1 188
Sales during 5th year:	
44 000 lbs. of coffee . . . . .	1 804
live stock run on the plantation . . . . .	225
	<hr/>
Total sales . . .	£ 2 029
Total profit. . . . .	841
less 15 per cent. to manager. . . . .	126
	<hr/>
net returns . . .	£ 715

or a return of 16.6 per cent. on a capital of £4 310 over and above a 3 per cent. interest on capital allowed for in estimated expenses.

(1) See No. 1541, B. May 1911.

B. *Plantation of 160 000 bushes.*

	£
Total cost of establishing plantation spread over 4 years . .	10 512
5th year:	
expenses . . . . .	
} estimated to counterbalance . . . . .	3 267
receipts . . . . .	
} one another . . . . .	3 310
6th year:	
expenses . . . . .	3 375
receipts . . . . .	6 505
total profits . . . . .	£ 3 130
less 15 per cent. to manager. . . . .	470
net returns . . . . .	£ 2 660

return of 25.3 per cent. on a capital of £10 512 over and above a 5 per cent. interest capital allowed for in estimated expenses.

- **Mocha Coffee Culture.** — RIES, M. and BARDEY, P. in *The Tea and Coffee Trade Journal*, Vol. XXVI, No. 1, pp. 19-26. New York, January 1914.

Mocha coffee derives its name from the small ruined town on the South Arabian coast of the Red Sea from which it used to be exported. It is absolutely unique product with a flavour and aroma quite distinct from Abyssinian variety, though many writers consider them identical.

The tree is cultivated in the province of Yemen, South-western Arabia, terraced slopes, a southern aspect being preferred. The seeds, after being separated from the pulp, are rolled in ashes and preserved in a dry place. Seedlings are raised in nurseries on a fertile and well manured soil; they are protected from the sun, watered frequently and transplanted once or twice before being finally planted out 2 to 3 yds. apart. Plantations are all in the immediate neighbourhood of wells, as irrigation is absolutely necessary; the soil has to be kept loose and permeable by repeated cultivations. The crop is harvested continuously from August to March; the seed is hulled in a small stone mill, spread out to dry and packed in bags made of woven aloe fibre («sansevieria») and lined inside with the leaves of palm trees («doutum»), this packing, being known in trade as the Mocha bag and constituting a kind of certificate of origin.

The trees belong to three main types: 1) pyramidal with the biggest branches at the base; 2) umbrella shape with the lower part of the trunk bare; 3) bush shaped.

In the low regions where rain is abundant, the fruit is larger but of inferior quality; in the hot dry uplands, growth is slower and the grain smaller and rounder, but of the finest quality.

The annual production of Mocha coffee is about 100 000 bags of 112 lbs. each, and the principal importing countries are the United States which takes 30 per cent., France which takes 20 per cent. and Egypt which takes 18 per cent., others being the Red Sea ports (7 per cent.), Germany (5 per cent.), England (5 per cent.), Spain (3 per cent.), and Austria (3 per cent.). About half the amount is exported from Aden, and half from Meccah.

635 - **Vanilla in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture Trop.* Year XIV, No. 154, pp. 105-109. Paris, April 30, 1914.

Vanilla is successfully cultivated on various kinds of soil in Madagascar not only on granitic alluvial soils, but also on the sandy soils of the coast and on basaltic or volcanic soils, though the two latter kinds are perhaps the most suitable. From a series of analyses carried out by the writer would seem that a soil with a high phosphoric acid content is specially good, the best at Nossy-Bé containing a minimum of 0.4 per cent. and one of the most productive plantation containing 0.75 per cent.

The most usual shade and support tree is *Jatropha Curcas*, but *Leucaena tomentosa* is also frequently used. Vanilla cuttings should always be at least 5 ft. long; they cost 2d to 2 1/2d each. Decomposed banana stems are frequently used as manure in vanilla plantations.

The production of vanilla in Madagascar has been increasing of recent years. The figures for 1903-1912 are as follows:

	Amount tons	Value £
1903 . . . . .	11.5	8 264
1904 . . . . .	9.1	6 892
1905 . . . . .	30.4	18 619
1906 . . . . .	40.0	19 029
1907 . . . . .	50.0	39 875
1908 . . . . .	56.4	41 748
1909 . . . . .	42.6	47 639
1910 . . . . .	42.2	50 846
1911 . . . . .	51.7	40 986
1912 . . . . .	112.0	142 217

Further increases are anticipated, but over-production will be checked by the growing practice of planting other crops in vanilla districts.

Plant bugs are destructive to vanilla in Madagascar, especially *Melanocoris viciae* which punctures the pods and young buds, causing them to fall. Preventive measures have not yet been thoroughly investigated, but it would seem that the only means of checking the parasite would be treatment with hydrocyanic acid.

An average yield of vanilla in the green condition would amount to 530 lbs. per acre, while expenses of establishing the plantation are estimated as follows:

	per acre
£	s
1st year - clearing ground, planting shade and support trees, planting vanilla cuttings, 3 hoeings . . . . .	14 7
2nd year - 3 hoeings, cutting shade trees, replacing cuttings .	5 17
3rd year - as 2nd . . . . .	5 17
4th year - as 2nd, pollination (22s) and harvest (14s) . . .	7 13
	£33 14

**The Cultivation of Poppies for Opium and Seed in Various Countries.** —  
*Enquiry made by the International Institute of Agriculture.*

The cultivation of poppies for opium in the Far East has been somewhat checked of recent years, but the crop remains an important one in many countries on account of the edible oil produced from its seeds. The replies to the circular letter on the subject sent by the Institute are abstracted below.

**AUSTRALIA.** — Victoria is the only State in the Commonwealth in which poppies are cultivated on a commercial scale, and even in that State, the area under the crop is very small, consisting of one or two acres during the years 1908-1912 with a total yield of 89 lbs. of opium in the whole period. The present price of opium is 30s a lb. and the product is used exclusively for pharmaceutical purposes.

**CHINA.** — According to the special convention of the Opium Agreement signed in 1911 between the English and Chinese Governments, the cultivation of the opium poppy in China and the importation of opium from India were to be proportionately and progressively reduced, starting from January 1st 1911, so that both local production and imports were to cease entirely by the end of 1913 and opium smoking to be prohibited after 1917.

**EGYPT.** — Poppies are cultivated in Upper Egypt chiefly for the sake of opium; oil is also extracted from the seeds and used for cooking.

Three varieties are cultivated, having respectively red, yellow and dark brown seeds, and all belong to the same species. In 1912-1913, 516 feddans (1 feddan = 1.25 acres) were under the crop, which is partly raised as a pure crop and partly mixed cultures with other crops, such as wheat, barley, onions, fenugreek, *thamus oxyacantha*. Seed is sown in October, after the flood, at the rate of 1 kadah (2 1/4 quarts) per feddan and mixed with fine soil to facilitate the operation; no manure or irrigation water is applied. After a month the plants are singled 6 to 8 in. apart and 12 days later they are earthed up. When the plants are five months old, an incision is made in the capsules and the opium is collected the following day in the form of the solid exudate, which is then kneaded into cakes and dried in the sun for 10 days. Each capsule is tapped three times.

A considerable amount of labour is required for the crop, making the cost of cultivation rather high:

	Cost per feddan, piastres (2)
Ploughing . . . . .	50
Sowing . . . . .	4
Singling . . . . .	4
Earthing up . . . . .	9
Making incisions . . . . .	45
Collecting opium . . . . .	120
Kneading " . . . . .	9
Transport and storage . . . . .	9
Hand threshing the seed with flails . . . . .	10
Cleaning the seed . . . . .	10

270 (£2 15s 7d)

(1) 1 feddan = 1.038 acre.

(2) 1 piastre = 2.46d.



The total production per feddan amounts to  $1\frac{1}{2}$  ardebs (8 bushels of seed, worth 112 piastres (£ 1 3s), 8 rotl (1) of opium, worth 960 piastres (£ 9 17s) and 120 rotl of oil. The stalks are sold for fuel and fetch 5s 12d per feddan. An ardeb of seed yields about 80 rotl of oil, and the opium contains an average of 8 to 12 per cent. of morphine. Prices are very stable.

The only parasite dangerous to poppies is *Agrotis ypsilon*, which is kept in check by hand-picking the larvae.

No statistics exist on the consumption and exportation of opium, but imports for the years 1909-1912 were as follows :

	Amount lbs.	Value £ s d
1909. . . . .	11 030	7 10 9
1910. . . . .	12 961	11 5 6
1911. . . . .	10 815	8 0 2
1912. . . . .	4 309	5 7 6

FRANCE. — Poppies are cultivated in various districts, more especially in the departments of Somme and Pas de Calais, but also in those of Aisne, Aube, Cher, Doubs, Maine-et-Loire, Nièvre, Nord, Seine-et-Marne, Deux Sèvres, Vienne and Yonne. The crop is raised for the sake of the oil obtained from the seeds, which is used as an edible oil in the north and also for the manufacture of paints. The two varieties of *Papaver somniferum* known as Pavot Gris Ordinaire and Pavot Œillette Aveugle are grown. The area under this crop, which was between 12 000 and 15 000 acres in 1900, was reduced to between 6450 and 6650 acres in 1910 and 1911.

Poppies replace beets or flax in the rotation. The land is prepared by autumn and spring cultivations, and seed is sown at the beginning of April at the rate of 2 to 3 lbs. per acre. Farmyard manure is applied to cake residues, with 4 to 5 cwt. of superphosphate per acre. After-cultivation consists in hoeing and singling to a distance of 8 in. apart. Eight to twenty-seven bushels of seed are obtained per acre, yielding 45 to 50 per cent. of oil. Mean annual values for the period 1902-1911 are as follows :

Total area under the crop . . . . .	acres	10 295
Total production . . . . .	tons	5 100
Production per acre . . . . .	lbs.	1 108
Total value of crop . . . . .	£	77 048
Value of 1 cwt. of seed . . . . .	s	15

*French publications dealing with the subject.*

MOHAMED EFFENDY CHARKANY. — *Thèse sur l'opium, soutenue devant l'Ecole de Pharmacie de Paris*. Paris, H. Plou, 1896.

GASTINEL. — *Monographie des opium de la Haute-Egypte (Mémoires de l'Institut Egyptien, Vol. I)*. Paris, 1862.

(1) rotl = 0.9905 lb.

SALLÉ et Cie. — *L'opium, son histoire, sa culture, ses applications*. Paris, 1900.  
*Journal de Pharmacie et de Chimie*.

Series	Vol.	Page	
3	13	105	Culture en Arménie.
"	23	99	Récolte en Bithynie.
4	1	415	Culture dans la Haute-Egypte.
"	7	137	"
"	18	66	Culture en Chine.
"	19	158	Culture dans l'Inde.
5	6	481	Culture dans la Zambézie.
6	21	403	Culture aux Etats Unis.
"	25	542	Culture.

HALLAMEL has also recently (1913) published a book on opium.

JAPAN. — Poppies are only cultivated on a very small scale for the of the flowers and seeds, which are used in perfumery.

BRITISH INDIA. — Poppies are cultivated in the United Provinces gra and Oudh, in certain States of Rajputana, and in Central India, they are no longer grown in Bihar. Opium production both for home mption and for export is the main object, but the seed production so considerable, as shown by the following figures :

*Exports of poppy seeds.*

	Amount cwt.	Value £
1910 . . . . .	814 871	559 890
1911 . . . . .	770 741	545 871
1912 . . . . .	497 862	391 899

The alkaloids morphine and codeine are manufactured from the opium are mostly disposed of on the London market.

Owing to the restriction in the export of opium to China the area devoted to poppies in India has decreased from 564 585 acres in 1906-1907 to 558 in 1912-1913 and to 156 250 in 1913-1914.

The white variety is commonly cultivated, and grown from October larch after maize or millet. Usually it is grown alone, but occasionally preceding maize crop is left standing to attract the insects which would otherwise injure the poppies. Heavy black cotton soils are preferred, and ls are selected in the highly manured circles round the villages, which re 150 to 200 maunds (1) of cattle dung per acre per annum; in Fateh- the land is often manured by herding sheep and goats on it, the dung of ch is supposed to be of peculiar value. The plants benefit greatly if y are irrigated with well-water impregnated with nitrates (Khari), and ured with earth impregnated with saltpetre (Nonamati) or well rotted dung; ashes are also extensively used as top dressings. A finely rdered tilth is absolutely essential and the land is ploughed as

(1) maund = 28 lb.

many times as the cultivator has leisure for. Seed is sown from the middle of October to the end of December at the rate of about 3 lbs. per acre, having been previously mixed with earth. The ground is almost always prepared for sowing by a watering and in the drier portions of the United Provinces the plants are irrigated once a fortnight or three weeks between germination and harvest time, while in the Benares division four or five waterings are usually sufficient. The field is kept scrupulously clean, being weeded and thinned at frequent intervals.

The crop is ripe in February or March and the opium is extracted by means of incisions made in the pods in the afternoon, the exuded juice being collected the next morning. Each pod is lanced three or four times at intervals of two to four days. Linseed oil is freely used to remove opium that has hardened on the pod and as a medium in which to store the opium to prevent its drying out.

The process of manufacture is not ordinarily undertaken by the cultivator, but is in the hands of firms by whom the produce is bought and whom the cultivator is often partly financed. The process is a very simple one: the opium is kneaded into balls and stored in racks covered with dry leaves and stalks of the poppy plant. As it dries, the balls are apt to lose their shape and are periodically examined and reshaped, considerable importance being attached to the balls being spherical in shape and free from cracks, especially by the Chinese connoisseur.

Cultivation expenses amount to roughly 40 rupees (£ 3 6s 8d) per acre.

The specific diseases to which the poppy is subject in India are: *a*) the canker; *b*) sun burning; *c*) sclerosis, the symptoms of which are a gradual drying and hardening of all the plant tissues; *d*) *patechia*, in which the cuticle of the leaves becomes more or less densely covered with speckled spots somewhat resembling those caused by the bite of insects; and *e*) gangrene, which mostly affects the soft, herbaceous parts of the plant. Injuries are also caused by broomrape, various fungi, insects and birds.

The output of opium during 1912-1913 was approximately 19.5 cwt., excluding that grown in the Native States for which no reliable statistics can be given. The average content of morphia in opium ranges from 6 to 10.26 per cent. The whole of the opium produced is sold to Government by the cultivators at a fixed price and is then manufactured for export and for internal consumption. The quantity intended for export is put up to public auction in Calcutta every month in chests containing 140 lbs. each.

Imports and exports of opium during the period 1908-1912 are given below; imports consist mostly of Persian and Turkish opium required for pharmaceutical purposes; exports go to China and other countries.

	Imports lbs.	Exports cwt.
1908. . . . .	213	88 210
1909. . . . .	260	81 329
1910. . . . .	431	68 392
1911. . . . .	422	62 575
1912. . . . .	554	42 787

during 1913 the quantity to be exported was fixed at 32 125 cwt., systematic reduction being due to the policy of restricting exports from India. The estimated annual consumption of opium in British India was 982 cwt.

For further reference see :

*India's Dictionary of the Economic Products of India*, Vol. VI, Part I. London, W. H. and Co.

**NETHERLANDS.** — Poppies are cultivated in districts possessing a rich soil, more especially in the provinces of Groningen, North Holland, Friesland, Holland and Zealand. A variety of *Papaver somniferum* L. with blue capsules, indehiscent capsules and grey or grey-blue seeds is in common use, the plant is cultivated for the sake of its seeds from which oil is extracted. The average area under this crop during the period 1901-1911 was 808 acres, increased to 1623 acres in 1912 owing to the rise in price of the seeds. Poppies follow red clover, oats or barley in the rotation; cultivation consists in ploughing deeply and applying dung or superphosphate according as the preceding crop was a cereal or a leguminous crop. Seed is sown in April or May in drills 24 to 26 in. apart and the plants are singled to a distance of 5 in. apart in the rows. The crop is kept hoed and ripens in August, and is harvested in a very dry condition so that the capsules may be threshed immediately; if threshing has to be delayed the plants are tied in bundles and placed in small heaps.

The average production per acre amounts to 18 to 22 bushels of seed, yielding 50 to 60 per cent. of oil, and 12 to 16 cwt. of straw. Poppy cake is a useful cattle food, but the poppy straw is of very little value.

Prices for poppy seed ranged very high in 1910, causing an increase in the area under the crop in 1912. As a result, before the harvest the seed was sold at £1 9s 4d a cwt., but after it fell to about £1.

Poppies are a hardy crop and have few enemies in the Netherlands.

There exists no special publication on the cultivation of poppies in the Netherlands, but a chapter is devoted to the subject in *Byzondere Plantengedrag*, J. Z. TEN RODENGATE MARISSSEN. Groningen, J. B. Wolters.

**PERFIA.** — Poppies are cultivated in all the provinces except Kazvine, Gilan, Guilan, Mazenderan, Astrabad and parts of Azerbaydjan. The white flowered variety is commonest and the red and purple flowered varieties are also grown, the production of opium being the chief object. The crop is very early, especially in the south, so that the crop is usually sown by melons, sesame, lentils, beets, millet, etc., and then the land is again put to poppies, or the poppy crop may be followed by two years' fallow. Cultivations consist of a single ploughing (or spading in the South) and dung or nightsoil is used as manure. Seed is broadcasted at the rate of 1.4 to 1.8 quarts per acre. The crop is hoed for the first time as soon as the seedlings have four leaves and they are then singled to a distance of 18 in. apart; a second singling takes place after 20 to 30 days, further singling out the plants to 10 to 12 in. apart. Irrigation is applied as required with a maximum of three waterings.

Opium collecting from incisions begins when the two lowest leaves have turned yellow, when the three upper leaves begin to lose their color and the operculum of the capsule blackens. Incisions are made at midday and the exudate is collected at sunrise the next morning. A second incision is made a few days later, but the yield in this case is much smaller.

Expenses for raising the crop amount to about £5 per acre, average returns being 200 lbs. of seed and 32 lbs. of opium per acre, fetching 17p per cwt. and 14s 4d to £1 5s 2d per lb. respectively. Imports and exports of opium are as follows:

		Amount lbs.	Value £
Imports . . .	1908	997	354
	1909	543	174
	1910	610	232
	1911	7915	7 636
	1912	2 421	2 834
Exports . . .	1908	580 737	250 112
	1909	663 345	306 034
	1910	494 434	229 042
	1911	528 959	391 317
	1912	719 162	607 238

The home consumption is considerable, though its actual amount is unknown.

SERBIA. — Poppies are cultivated on a large scale only in the parts annexed during the late war, and no data on the subject are at present available.

637 — *Cymbopogon coloratus* Oil from Fiji. — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 48-51. London, January-March 1914.

Recent investigations have been carried out at the Imperial Institute on the composition of the essential oil of *Cymbopogon coloratus*. The principal constituents are citral (40 per cent.) and geraniol (23 per cent. in the free state and 10 per cent. in the form of geranyl acetate); the oil is therefore intermediate in composition between citronella and lemon-grass oils and was assigned a value intermediate between those of the two above products by commercial experts.

638 — Winter Spraying of Fruit Trees with Nitrate of Soda. — BALLARD, W. and VOLCK, W. H. in *Journal of Agricultural Research*, Vol. I, No. 5, pp. 4374 + 2 plates. Washington, D. C., February 1914.

These experiments on the effect of winter spraying with various solutions on the time of blooming and yield of fruit were begun in February 1910 and continued during 1913. The orchards used consisted of the Yellow Bellflower variety of apples, which bloom abundantly but only set a poor crop of fruit.

Seven 12-year-old trees were sprayed on February 2, 1912, with a solution of: nitrate of soda 50 lbs., caustic potash 7 lbs. and water 50 gallons, at the rate of 7 gallons per tree. Adjoining this row was a check row

ven trees which received no winter spraying and a selected vigorous which received 50 lbs. of nitrate of soda ploughed in and washed by the rains. In April it was found that the nitrate spraying had nced the blossoming period about two weeks ahead of the normal pe-

The foliage buds were not so much affected, their condition remain- imilar to that of the check row. Later in the spring the effect on the fo- growth became more pronounced and the sprayed trees assumed a vigorous green appearance than the check trees. The single tree received 50 lbs. of nitrate of soda applied to the soil showed no greater it than the check trees. During the summer both rows received spray- for the control of apple powdery mildew and codling moth, and the loss from these and other insect pests did not not exceed 1 per cent. ther plot.

In the autumn, the check row of trees yielded 8 loose boxes of fruit, the nitrate-sprayed row produced a little over 40 boxes. The single which received 50 lbs. of nitrate as fertiliser showed no increased produc-

In the spring of 1913 this row of nitrate-sprayed trees showed plump fruit buds and blossomed several days ahead of the control showing that the effect of the winter spraying continued to some extent ie second year.

Similar experiments were carried out in 1913, using different solutions ; is found that:

1. A solution of nitrate of soda (1 lb. per gallon) stimulates the trees osom earlier, and the effect is increased by the addition of either ic soda or caustic potash.
2. The effect is proportional to the strength of the solution within cer- limits. The best results were obtained with a solution of the following gth:

Nitrate of soda . . . . .	200 lbs.
Caustic soda . . . . .	20 lbs.
Water . . . . .	200 gallons

3. Oxalic acid at the rate of 50 lbs. per 125 gallons of solution can ce the caustic soda with equally good results.
4. Nitrate of lime (130 lbs. per 100 gallons) and calcium cyanamide bs. in 100 gallons) also caused the trees to bloom earlier.
5. Sulphate of ammonia is considerably less effective than nitrate of

6. Sodium chloride produced a distinct effect, sulphate of potash a t effect and double superphosphate none at all.

7. The results with stone fruits were not so striking as those with s and pears, but it is possible that stronger solutions together with r and repeated spraying may bring about better results.

Rain immediately following the application will wash much of the rial off the trees, and it appears that at least a week of clear weather ld follow the spraying, in order to ensure good results. The greater

danger of injury from frost that might result from forcing trees into bloom earlier than normally would have to be taken into consideration in making practical use of nitrate spraying in winter.

- 639 - **The Effect of Dust from Cement Mills on the Setting of Fruits.** — ANDERSON, P. T. in *The Plant World*, Vol. 17, No. 3, pp. 57-68. Tucson, Arizona, March 1914.

The decrease in the productivity of fruit trees in the vicinity of cement mills is attributed to the solution of the dust in the stigmatic secretion which prevents the germination of the pollen. The dust contains large amount of alkaline soluble lime, and artificial tests show that pollen will not germinate even in a very weak solution of the dust.

- 640 - **Shallow Cultivations in Vineyards.** — COUDERC, in *Comptes-Rendus de l'Assemblée Générale de 1914 de la Société des Agriculteurs de France*, No. 3, pp. 525-526. Paris, May 19, 1914.

In order to avoid chlorosis in shallow soils overlying chalky subsoil, very shallow cultivations, less than 1 in. deep, were adopted and gave good results. Not only were the vines less affected with chlorosis, but they also suffered less from drought. A light spring-time cultivator was used for the purpose, and cultivations had to be carried out before the weeds got any hold on the land in order to keep it clean. Such shallow tillage cannot be practised indefinitely, as after a certain number of years the soil must again be stirred to a greater depth and well manured in order to stimulate the growth and development of the roots, which would otherwise succumb to the attacks of phylloxera.

- 641 - **Influence of American Vine Stocks on the Quality of the Wine Produced Champagne, France.** — MANCEAU, F. in *La Vie Agricole et Rurale*, Year III, No. 621-624. Paris, May 2, 1914.

The wine produced from grafted vines has been compared with that from ungrafted vines each year since 1897. A number of research stations exist for the purpose in Champagne and growers send in numerous samples to be examined, so that a large amount of data is accumulating and will shortly be possible to publish a list of American vine stocks classified according to their influence on the resulting wine.

The quality of samples is determined partly by tasting and partly by chemical analysis. Testing is carried out at various times of year in the January or February following the vintage, and again in subsequent years during the second fermentation in bottles for champagnisation; the reliable results are obtained by following out the process of maturation of the wines. The investigations have shown that only a few stocks exercise an unfavourable influence on the wine; the majority when grafted with Meunier, Pinot noir and Chardonnay blanc, yield wines up to the general standard of the district; specially good stocks recommended by the writer are the following:

Chasselas X Berlandieri 41 B for calcareous soils.  
Berlandieri X Riparia 420 A, 34 E. M. and 157-11.  
Riparia X Rupestris 3309 and 101-14.

The stocks influence the ripening period: for instance Pinot noir on paria Gloire of Montpellier ripens 8 to 10 days sooner than on its own roots; on Chasselas Berlandieri 41 B it is 5 to 6 days earlier; Mourvèdre  $\times$  rupestris 1202 on the other hand retards its ripening 8 to 10 days, while paria  $\times$  Rupestris 5306 and 3309 also have a slight retarding influence.

**The Papaya in Hawaii (1).** — HIGGINS, J. E. and HOLT, V. S. in *Hawaii Agricultural Experiment Station, Bulletin*, No. 32, pp. 44. Washington, March 26, 1914.

The papaya (*Carica papaya*) flourishes in all drained and aerated soils in Hawaii. Though irrigation will increase the crop, an abundant water supply is not essential and papaya will give good results on a soil just too dry for oranges. Suckers should be removed at first, but after the plant has rooted two or three times, the main stem should be cut down and replaced by one of the suckers left for the purpose. The whole plantation should be renewed after about four years' bearing.

The fruit will travel well if certain precautions be taken, *i.e.* the fruits, preferably those belonging to the long-fruited varieties, should be picked at the first sign of ripeness, wrapped in paper and packed in straw board

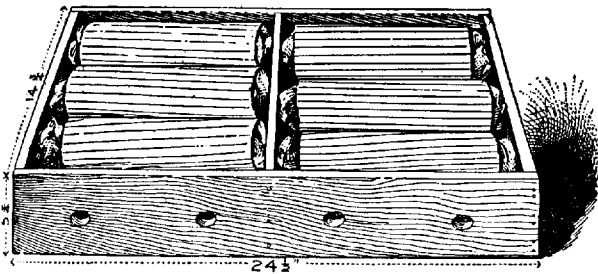


Fig. 1. — Crate for transport of papayas (open).

well ventilated crates (the size of the latter is indicated in the accompanying figs. in inches).

Seed kept for propagation is washed and dried and preserved in glass bottles; it is sown in a well drained soil and germination takes place in from 10 to six weeks according to the temperature; when one month old the seedlings are transferred to a nursery, and at two months old are planted about 10 feet apart. Experiments on vegetative propagation carried out at the Experiment Station have given promising results, making it probable that the fruiting season will eventually be made several months earlier. In breeding papayas, the following points should be borne in mind:

(1) See No. 813 B. July 1913.

(Ed.).



1. Trees bearing their fruit high (more than 6 ft. from the soil level) are preferable to those bearing their fruits close to the soil.
2. Numerous lateral branches requiring frequent pruning are a disadvantage.
3. Hermaphrodite or elongata varieties are better than round dioecious varieties, as males represent 75 to 85 per cent. of the latter and cannot be distinguished before flowering.
4. The most desirable size of the fruit depends on the use to which it is to be put. Table fruit should not be too large, while fruits for the production of papain should, other things being equal, be as large as possible.

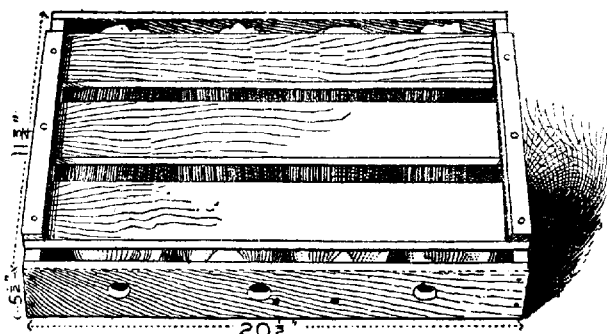


Fig. 2. — Crate for transport of papayas (closed).

and for this latter purpose too, fruit with a high papain content should be selected.

5. The long and round varieties should be kept separate and bred as constant and distinct types.

6. At present there is a tendency to unequal ripening of the opposite ends of the fruit which should be corrected. The ripe fruit should be of fine yellow gold colour, the flesh should be firm and of a yellow, red or pink colour, easily detached from the seeds and placenta and possessing a good flavour.

The papaya tree is subject to attacks from *Tetranychus* sp. on the lower surface of the leaves and on the fruits, and from the larva of the fly *Cryptoblabes aliena*, neither of which are serious enemies.

The harvest and preparation of papain are described in this bulletin.

643 — **Propagation of the Seedless Breadfruit.** — WESTER, P. J. in *The Philippine Agricultural Review*, Vol. VII, No. 3, pp. 97-99. Manila, March 1914.

The seedless breadfruit is one of the best and most nutritious fruit in the Philippines, but it is also one of the rarest owing chiefly to the difficulty of propagating it. The ability of the roots to sprout under certain conditions led to a series of experiments being carried out in 1913 at the

is Experiment Station with the object of finding a simple and practical method of propagation. The following method gave good results: cuttings 20 to 25 cm. (8 to 10 in.) long and 1.5 to 6 cm. ( $\frac{1}{2}$  to 2 in.) thick are struck in a bed consisting of a layer of clean sand 18 cm. (7 in.) thick situated in a sheltered and well drained position. The cuttings are inclined at an angle of  $45^\circ$  and buried three-quarters of their length, being set 20 to 30 cm. (8 to 12 in.) apart in rows 30 to 50 cm. (12 to 20 in.) apart. If planted in the rainy season, the cuttings require no special care; if not they must be watered. When 20 to 25 cm. (8 to 10 in.) high the cuttings are transplanted to a rich shaded soil, and when the plants are 60 cm. (24 in.) high they are ready for transplantation to the field. The roots should be disturbed as little as possible during the transplantation and a large ball of earth be moved with the plant. In replanting is important not to set the plant deeper in the soil than it was in the nursery and a plentiful use of water should be made both before and after transplantation.

### LIVE STOCK AND BREEDING.

**Results of Preventive Inoculation against Foot-and-Mouth Disease in Hungary, 1913.** — MEZAY, BÉLA in *Allatorvosok Lapja*, 1914, p. 238.

From observations made by the writer during the last campaign against foot-and-mouth disease in Hungary, it appears that, after undergoing preventive inoculation against this disease (aphtisation), a large number of animals became seriously ill. In many cases recourse had to be had to operations, while in others further complications caused by other diseases set up, and some cases resulted in death.

In one district, the disease reappeared two or three months after the first inoculation in a form more dangerous than the first.

**Utilization of Potato and Jerusalem Artichoke Haulms.** — VÖLTZ, WILHELM; BAUDREXEL, AUGUST; and DEUTSCHLAND, ARNOLD in *Landwirtschaftliche Jahrbücher*, 43, 46, Part 1, pp. 105-160. Berlin, March 11, 1914.

The writers carried out at the Berlin Agricultural College exhaustive experiments on the utilization of dried and ensilaged potato haulms and leaves and stalks of Jerusalem artichokes. The animals used for the experiments were three sheep and four milch-cows; they were fed good clover hay besides the experimental fodder. The haulm was from Silene potatoes, and was dried in a hot-air apparatus; some was fresh when cut while some had been frosted. For the utilization trials, two sheep were used. Each 3  $\frac{1}{2}$  lb. of hay with 1 lb. of haulm, the fresh haulm period preceding the dried haulm one.

From these trials, as well as from a previous one (1) made with haulm of Wohltmann potatoes dried on the field, it appears that the percentage digestibility of dried potato haulm is about as follows:

1 Cf. W. VÖLTZ and A. BAUDREXEL: Ueber die Verwertung des Kartoffelkrautes und der Kartoffelbeeren durch Wiederkäuer. *Landw. Jahrbücher*, Vol. 43, pp. 177-210. Berlin, 1912.

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calorie
64	57	53	66	68	63

There was very little difference between the three types, and none of them upset the health of the animals.

The amount of digestible nutritive matter contained in dried potato haulm appears from these experiments to be about the same as that in good meadow hay; this is confirmed by a later experiment on four milk cows, carried out with the object of ascertaining the effect of potato haulm on the quantity of milk and milk-fat and the total dry matter in the milk.

Ensilaged potato haulm was also prepared from the green haulm by two months in a silo under strong pressure; after this, part was dried and the other part preserved in tin boxes. The loss of crude nutritive matter in the silo was 33 per cent. on the organic matter and 25 per cent. on the crude protein, while the digestible nutritive matter lost 35 per cent. on the organic matter and 13 per cent. on the crude protein. The first ensilage trial was made with the moist ensilage; two sheep were fed daily 4.4 lbs. ensilage with 0.77 lb. hay and 3.72 lbs. ensilage with 0.65 lb. hay, respectively. Then followed an experiment with dried ensilage, during which one sheep was fed daily 0.78 lb. ensilage and 0.62 lb. hay.

Of the nutritive matter contained in the ensilaged potato haulm the following percentages were digested:

	Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calorie
Fresh ensilage . . . .	62	62	66	60	63	5
Dried ensilage . . . .	65	56	77	65	67	6

The leaves and stalks of Jerusalem artichokes were dried by hot air, and 1 lb. of them fed daily with  $\frac{3}{4}$  lb. of hay to two sheep. As percent of digestibility the following figures were found:

Organic matter	Crude protein	Crude fat	Crude fibre	N-free extract	Calorie
65	55	70	54	72	66

According to its content of crude nutritive matter and digestibility Jerusalem artichoke haulm is about equal in value to good meadow hay. When fed alone, however, it causes strong fermentation in the alimentary canal, so that not more than half the bulky food should be replaced by

**Feeding Experiments with Rice Gluten Food.** — HANSEN, REISCH, E. and SCHWEIGER, M. in *Deutsche Landwirtschaftliche Tierzucht*, Year 18, No. 21, pp. 245-248, Hanover, May 22, 1914.

Under the name of "Reiskleberfutter", a food for milch cows is sold in Germany; it consists of a mixture of rice gluten and rice meal. The latter is a by-product of the rice starch factories and is rich in protein, while the former is a residue of rice milling. The writers have conducted a feeding experiment with the mixture which has the following composition:

Dry matter . . . . .	93.30	per cent.
Crude protein . . . . .	36.94	" "
Pure protein . . . . .	31.25	" "
Fat . . . . .	11.86	" "
N-free extract . . . . .	36.87	" "
Crude fibre . . . . .	1.32	" "
Ash . . . . .	5.31	" "

The amount of nutritive matter contained in the food is so high that it places the mixture on a level with oil cakes containing an average amount of protein. Its starch value is, according to the authors, about 71.77 per cent. and its protein content 22 per cent.

The food was fed with meadow hay, dry beet slices and brewer's yeast mixed with molasses as basal ration, and compared with earthen cake and wheat bran. The animals experimented upon were Friesian and Friesian-Friesian cows in full milking. The quantity of rice gluten food was 15 lbs. during one period and 11 lbs. during the next. During the 75 days the experiment lasted, record was kept of the daily milk yield, of its composition and of the changes in the live-weight of the animals.

The results of the experiment are that the rice gluten food under examination has the same value as a mixture of earthen cake, dry beet slices and wheat bran; consequently the writer recommends it for the feeding of such cattle when it can be bought at a suitable price.

**Colt-breeding in Pennsylvania.** — COCHEL, W. A. and SEVERSON, B. O., *Pennsylvania State College, Agricultural Experiment Station, Bulletin* No. 122, 14 pp., Centre County, Pa., July 1913.

The writers carried out, in the State of Pennsylvania, where all the farmers buy their draught horses, a breeding experiment with 10 weaned Friesian and Percheron colts, with a view to ascertaining whether it is profitable for the farmer to breed his own draught horses.

The colts were divided into two groups of 4 and 6, and were fed, during the 532 days covered by the experiment, in the manner shown in Table I.

TABLE I. — *Daily Ration of each Colt.*

1. *Winter Period* (168 days).

8½ Hb.	Group I.	5 lbs. mixed grain (1);	8.2 lbs. maize ensilage;	7.4 lbs. hay.
	Group II.	5 lbs. mixed grain (1);	10.6 lbs. hay.	
12½ Hb.	Group I.	7.5 lbs. mixed grain;	13.1 lbs. hay.	
	Group II.	Same as Group I.		

2. *Summer Period* (106 days).

Both Groups: For the first 28 days: 5.5 lbs. mixed grain; 10.6 lbs. hay.

Afterwards: pasture, with mixed grain as supplementary food.

3. *Winter Period* (168 days).

1st Half: Both Groups: 8.4 lbs. of a different mixture of grain (2); 16.6 lbs.

2nd Half: Both Groups: 10 lbs. mixture (2); 17.5 lbs. hay.

Note. Mixture (1) was composed of: 5 parts maize.

3 parts oats.

2 parts wheat bran.

1 part linseed meal.

Mixture (2) was composed of: 6 parts maize.

2 parts oats.

1 part wheat bran.

1 part linseed meal.

The animals, which were then two years old, were broken to work at the third period of the experiment.

The experiment was carried out without mishap and gave the results shown in Table II.

TABLE II. — *Results of the Experiment.*

Average weight per colt at the beginning. . . . .	589.87
" " " " after the 1st. Period . . . . .	834.14
" " " " " 2nd. " . . . .	1097.71
" " " " " 3rd. " . . . .	1318.96
Average increase in live weight per colt in the 1st. Period . . . . .	244.27
" " " " " 2nd. " . . . .	263.57
" " " " " 3rd. " . . . .	219.23
Average daily increase in live weight per colt in the 1st. Period . . . . .	1.43
" " " " " 2nd. " . . . .	1.34
" " " " " 3rd. " . . . .	1.30
Total increase in live weight per colt. . . . .	727.09
Average daily increase in live weight per colt. . . . .	1.36
Total cost of food and labour. . . . .	\$ 980.893
Total cost of the ten colts by the end of the experiment . . . . .	\$ 1893.390
Value of the ten colts . . . . .	\$ 2.350
Profit on the ten colts . . . . .	\$ 456.610
Profit per colt . . . . .	\$ 45.66

648 — **Crossing Bison and Cattle.** — 1. BOYD, MOSSOM M. (Bobcaygeon, Ont., Canada) *The Journal of Heredity*, Vol. V, No. 5, pp. 191-197. — 2. GOODNIGHT, CHARLES (night, Texas) *Ibid.*, pp. 197-199. Washington, May 1914.

1. — Mr. Mossom M. Boyd publishes the first results obtained in his four years' experiments in the crossing of bison with domestic cattle.

He obtained about 30 hybrids. As to colour, the offspring of Herdams had white faces, but apart from these, the animals were practically whole-coloured, and were either brindled or a rich brown-black. The hybrids varied between a tawny red and brown. The hybrids were, as a rule, larger and better proportioned than the bison; they stood upright, had a less shaggy coat, and were altogether of better appearance.

$\frac{3}{4}$  bisons, the product of a bison bull and hybrid females, did not differ one from another more widely than do different specimens of hornless Aberdeen-Angus. Their characteristics were midway between those of their parents. The  $\frac{1}{4}$  bisons (Aberdeen-Angus or Hereford sire, hybrid dam) all exhibited the same build, but varied in colour. They resembled their parent as much as the other. The same is true in the case of the  $\frac{1}{8}$  bison, obtained by a second cross with a pure domestic bovine animal. To the ordinary observer, the  $\frac{3}{4}$  bison is easily confused with the bison, but the fine texture of the coat will alone serve to distinguish the  $\frac{1}{4}$  bison from pure-bred domestic cattle. Taken altogether, the type of each class is homogeneous, and the proportion of bison blood regulated the likeness to that animal. As was expected, the proportion of bison blood did not plate the appearance of the cattaloos (offspring of two crossbred animals). A number of these animals exhibited a greater similarity to the bison than did the hybrids.

On the whole, the results obtained are encouraging. Two especially interesting points immediately emerge, namely:

1. Crossing with bison is capable of improving the coat of the animals. Cattaloos with even less than  $\frac{1}{10}$  bison blood may, with proper nutrition, have as good a coat as  $\frac{1}{2}$  or  $\frac{3}{4}$  bisons.

2. There is hope of being able to effect a great improvement in capacity for beef-production. The bison's hump does not, as most people imagine, consist of a lump of fat, but of masses of muscle attached to neural spines double the length of those of domestic cattle. It is borne in mind that the beef from the backs of cattle is the most valuable, it will be easily understood that the development of this characteristic is of first-rate importance. The writer obtained hybrids with humps 9 inches thick.

It is noteworthy that the experiments of the first class are not attended with some danger. In this case, the principal effect of the first crosses was, in every cow without exception, an abnormal secretion of the uterine fluid, which proved fatal in a large proportion of cases. Fortunately, considering that nothing of this kind had been in the least expected, the experiment had been made on a very large scale.

It should be observed that the writer was unable to raise a single fertile male hybrid. Of six born, only two survived the first 24 hours, and these one was killed at an early age, without having been tested, and the other was barren. This agrees with the experiments made by Col. Ch. Daught, who states that he was unable to raise hybrid bulls. Ten  $\frac{1}{4}$  bisons were obtained, of which four were tried; only one proved fertile. Of five  $\frac{3}{4}$  bisons only one was a bull, and he died as the result of an accident. The only  $\frac{1}{8}$  bison tried proved fertile. In 1905 a  $\frac{3}{8}$  bison was successfully reared, the offspring of a cross between a bison and a  $\frac{1}{4}$  bison cow. This cross was interesting from the fact that difficulties of the same kind as those mentioned above in connection with the cross were met with. This bull sired one calf in 1911 and four in 1912.

He is of a more elegant build than the true bison, and has a very well developed back.

The results given by the crossbred cows are as follows: of 24 hybrids 15 were barren, and only three were regular breeders. Up to 18 years of age they had respectively 9, 10 and 12 calves. Of the twelve  $\frac{1}{4}$  bison cows only one was barren. Of four  $\frac{3}{4}$  bison cows only one proved barren but it must be admitted that the bull was not a good breeder. Of five  $\frac{1}{8}$  bison cows, one was spayed at 5  $\frac{1}{2}$  years, without having had a calf to that time. The other four were fertile.

The writer has not yet been able to obtain any results from the cattaloos, the experiments with which are still going on at the present time.

2. — Col. Goodnight has carried out crossing experiments in Texas between bison and domestic cattle. By putting domestic cows to a bison bull, he has only been able to rear successfully one bull-calf. The  $\frac{3}{4}$  bison bulls proved barren, though the cows were perfectly good breeders.

Cattaloos shew a certain number of advantages over domestic cattle. They have a much higher disease-resisting power, especially as regards "Texas Black Leg" and Texas fever. Secondly, their weight is higher, as well as their beef yield (fully 70 per cent.). The beef is of good quality as never becomes leathery as it does in the bullock. The great development of the dorsal region enables them to produce about 150 lbs. more than a domestic animal. They are not subject to cattle panic and do not flee before storms, but face them as bison do. They can stand privation of water much longer than other animals; they are docile and never fight and can do well under conditions which would be fatal to other animals.

649 — **Observations on the Origin and Distribution of Breeds of Cattle in French West Africa.** — JACOB DE CORDEMOY, H. in *L'Agriculture Pratique des Pays Chauds*, Year 14, No. 130, pp. 24-36. Paris, January 1914.

The cattle of French West Africa may be traced to two definite types: 1) the zebu, or humped ox; 2) the humpless (taurine) type.

These two types have different areas of distribution, but at the borders of the two areas occur numerous races of a mixed or abnormal character making the distinction more difficult. What is the primary origin of the types? The zebu is certainly an imported type, of Hindu origin, and its line of advance can easily be traced from the East to the West coast of Africa. The origin of the taurine type is a more disputable matter. Many writers admit the Asiatic origin of the taurine stock in Guinea, but Pécaud, who has long made a study of the cattle of Dahomey, thinks that the taurine type is indigenous to Central and West Africa.

The writer does not share this opinion, for two reasons: 1) many Central and West African tribes were cannibals, a practice not observed where meat is obtainable, as is the case when cattle are raised; 2) it is difficult to reconcile the existence of indigenous breeds of cattle with the fact that the aboriginal race practises stock raising; the only tribes which practise it are the Peuhlish peoples and the descendants of Peuhlish mixed marriages and the Peuhls are foreign immigrants.

The zebu type may always be recognized by the hump, more or less developed, above the withers.

The other type is the Asiatic taurine type, which may be recognized by its height and more especially by the horns, which are strongly developed lyre-shaped, a characteristic which persists in all breeds derived from that stock. A further confirmation of the Asiatic origin lies in the fact that two types of cattle are found in all the countries right across the continent.

Dr. Decorse has described a third type, which he calls the Lake Tchad type, but from the description he gives of it it appears to be merely an Asiatic breed. The writer's opinion is shared by the Belgian veterinary surgeon Willaert, who only recognizes the zebu and taurine types.

The zebus were introduced by the Peuhl invasion; they advanced westward along the 14th parallel, and from there some must have gone up some distance down the Niger, but they followed rather a north-westerly route, on account of the trypanosomiasis in the south. Nowadays, the distribution of the zebu is limited to the south by the 13th parallel, and to the north by Upper Guinea. The two chief centres of the breed are, on the one hand, Senegal, and on the other, the countries round the mouth of the Niger.

The taurine type, also introduced by the Peuhls, seems to have been taken up by them at a fairly early period to the natives of Upper Dahomey. It now forms the only bovine population in Dahomey and Guinea. There are three distinct breeds or varieties:

1. The Borgu breed, in Upper Dahomey.
2. The small Somba breed, found in the neighbourhood of Jugu and the Atacora Range.
3. The Wemé or Lagoon breed, in Lower Dahomey; this breed is of small stature and appears to be degenerating in consequence of unfavourable conditions of soil and climate.

Variations due to climate are very noticeable in Guinea. The characteristic breed of Guinea is the N' Dama, which has produced two varieties, small (43 in. high) and another taller (55 in.), which Ghebbard and the writer believe to be two modifications, produced by the climate, of one and the same breed.

**- Connection between Growth of Bone, Horn Development and Performance in Cattle.** — MÜLLER, MAX and NARADE, K. in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 1, pp. 1-40. Berlin, March 11, 1914.

After a short summary of Laurer's studies on the connection between growth of bone and horn development in Kehlheim (1), Simmental, and Lowland cows, the writers discuss the results of similar work on 59 Dutch, 59 Shire and 18 Simmental cows. These investigations were carried out on pedigree animals, partly imported and partly bred at Hoksloot.

As in Laurer's investigations, the circumference of the cannon bone,

[1] A local brachycephalous draught breed, chiefly bred in the Upper Bavarian Palatinate.



and the length and circumference of the horns were taken as test measurements. Besides these, ten other measurements were taken with the object of throwing light on other points. After being measured, the animals were divided into groups and studied as to the connection between horn development and size of bones, between horn development and age, and between size of bones and age. The measurements of the Hokkaido-bred cows were compared with those of the imported ones. Besides the above, the relation between bone and horn development on the one hand and milk yield on the other was also studied in Ayrshire cows and at the same time the milk yields and live weights were compared with the horn and bone measurements.

The investigations led to the following conclusions:

1. In the breeds examined, increase in the size of the bones is correlated with decrease in the thickness and length of the horns, as Lutz had already found. This correlation seems to be more marked in Ayrshires than in Simmentals or Dutch cows.

2. The imported and Hokkaido-bred Ayrshire and Dutch cows did not show any appreciable difference in the circumference of the cannon-bones. The absolute circumference of the horns seems to diminish from generation to generation in Ayrshires and Dutch cows bred in Japan. The absolute horn length of the Ayrshire cows born in Japan is greater than in the original Ayrshires, while in the Dutch cows the opposite takes place. The different growth of the horns in the original breeds and in the animals raised in Japan is to be attributed only to the difference of environment.

3. The small-boned Ayrshire cows are in general, notwithstanding their relatively smaller live-weight, better milkers than the large-boned ones weighing about 110 lbs. more. Also the fine-horned Ayrshires under experiment proved better milkers than the thick-horned ones, while length of bone was not correlated with any difference in this respect.

It appears that well developed bone and slightly developed horns in young animals point to a continuation of growth of body, while moderately developed bones together with highly developed horns are signs that body growth will stop early.

651 - **Raising and Fattening Beef Calves in Alabama.** — GRAY, D. T. and W. F. — *Bulletin of the U. S. Department of Agriculture*, No. 73, 11 pp. Washington, March 30, 1914.

Experiments were carried out to determine the cost of raising calves to the age of 9 1/2 months or the profits to be obtained, if any, by carrying them on and fattening them out at 12 months. Sixty-four calves from Aberdeen Angus herd were selected for the purpose. The calves were born in the spring, ran with their mothers on the pastures till late autumn were then weaned and prepared for fattening from December 21 to January 17, receiving broom-sedge hay (consisting chiefly of *Andropogon scoparius*), maize silage and cottonseed meal. On January 17, 49 of the calves were put on to fattening rations and kept on this diet until April 1st.

The average weight at 9 1/2 months was 460 lbs. and the average cost of raising the calves to that age was \$ 14.36. During the fattening period

average daily increase was 1.37 lbs. on a ration of 4.4 lbs. of cottonseed oil, 23.9 lbs. of maize silage and 2.76 lbs. of broom-sedge hay, so that lbs. of live weight increase required 323 lbs. of cottonseed meal, 11 lbs. of maize silage and 201 lbs. of hay, costing \$ 7.3. The fat was sold at \$ 5.87½ per 100 lbs., while the cost of raising and feeding them only amounted to \$ 3.61 per 100 lbs. A profit of \$ 436.19 obtained on the whole herd, or an average of \$ 6.81 per calf.

**Cattle-Breeding and Dealing in Senegal.** — ADAM, J. in *L'Agriculture Pratique des Pays Chauds*, Year 14, Nos. 131, 132 and 133, pp. 65-80, 149-157 and 193-210. Paris, February, March and April 1914.

The physical conditions of the colony of Senegal make it favourable cattle-rearing. The nearness to European ports points to beef production as the most suitable branch of the industry and from this standpoint Senegalese cattle may be divided into three groups.

1. The pure-bred Senegal zebu, humped ox, or Gobra, a Peuhlish variety of the zebu type. This is a heavy-framed breed, with a moderate beef-producing capacity, an average live weight of 750 to 900 lbs. yielding 42 per cent. dead weight of medium quality meat, not very spotted. Beef-producing capacity of the Moorish or Gabarougé variety is still lower.

2. The N' Dama or humpless ox, which is of smaller size, but has a better-knit frame and better developed hind-quarters. The beef is of better quality than that of the zebu, and the average weight is 350 to 450 lbs. There are two varieties, the Gaboon and the Niokdo, the latter being smaller of the two.

3. The mixed type (jakoré, warlé, n'dama-match), resulting from a cross between the two preceding breeds. This type is by no means uniform, as in native cattle-raising the crossing is promiscuous, but on the whole it is a good animal for the butcher, a full-grown bullock weighing on an average 650 lbs.

The distribution of Senegalese cattle is governed by natural conditions, by the zone where trypanosomiasis is endemic. Generally speaking, the N'dama breed is by far the hardiest and the most disease-resisting, and predominates in districts where water is scarce or where trypanosomiasis is prevalent, *i. e.* in the districts round Bakel and Matam, while about Niakhar and Podor one meets with zebras as well, and crossbreds predominate. The zebu predominates in the neighbourhood of Dagana, and, on account of adverse local conditions, it remains without much size and muscle, and also in Djoloff and Baol, where the best beef-producing zebu is found. There are crossbreds there also, while in the M'javes, where pure breeds cannot live, only crossbreds and N'damas are to be seen.

Pure bred N'damas are predominant in the Serère Provinces, along with crossbreds, and produce good butchers' beasts, and the same applies to Sine Salum. At Niani-Ule, in Upper Gambia, and in Casamanca, they constitute the whole of the cattle. In Lower Casamanca, stock breeding is difficult, on account of the damp climate.

Senegal does not afford any well-defined stock breeding districts. Stock-breeding is distinct from crop growing, and there is a violent hostility between the two occupations. The negro races of Senegal must be classified into two divisions: first the Peuhls, who are nomadic and pastoral, and secondly the "Toucouleurs", Sérères, Mandingues, Ouoloffs, etc., who have a fixed abode and till the land. Usually, Senegalese herds are subjected to a system of migration.

The centre of Senegal consists of a huge plain, called the Ierlo, intersected in various directions by sort of gulleys. Here are to be found pools and also wells or "seïanes", dug by hand at those points in the valleys where water is held up in the wet season. It is on this plain that the cattle are pastured during the wet season. As water becomes scarcer, the Peuhls return to the dry-season feeding-grounds; those from the North, North-East and East reach the banks of the Senegal, thence from the West go to Djoloff, and those from Baol, to the Sérère Province. The young stock do not take part in the migration, but remain in the encampment together with a few milch-cows.

In some regions, as for instance in parts of the Luga district and on the coast in the neighbourhood of Saloum, the herds are stationary. As a rule, the cattle of the Toucouleurs, Ouoloffs, Sérères and the various tribes of Casamanka migrate short distances. The total number of cattle in Senegal may be reckoned at 800 000 head, and there are about 150 000 butcher's beasts.

The methods of cattle-breeding in vogue among the Peuhls, as well as those practised by other natives, are crude to the last degree. They make no provision of forage to feed their stock during the dry season, so when the latter arrives they are in a very bad way, and often lose their beasts, which die of starvation. The only care the native stockbreeder does take is to water their cattle, and even then they do not get as much as selecting suitable pools, so that only too often the stock drink from muddy water, swarming with the larvae of parasites. The repeated privations to which they are exposed have at length rendered the Senegalese cattle adapted, so, to speak, to enduring thirst. They can go two months with only one drink every two days, or even every three days, according as they may chance to come across a watering-place, and it is no wonder that with no more care than this the Senegalese cattle give so good a return as they do.

The calves are deprived from birth of part of their mothers' milk, weaned as soon as they can graze, and fed on a bare maintenance diet all the growing period, appreciably retarding their development. It is true that they share the supplementary ration sometimes given to the mothers, but that does not make up for the lack of sufficient milk.

**Karakul Sheep in the Argentine.** — Dirección General de Ganadería, Buenos Aires, in *Boletín del Ministerio de Agricultura*, Vol. XVII, No. 1, pp. 122-130. Buenos Aires, 1914.

The small herd of Karakul sheep established in the mountainous district of Azul was presented to the Argentine Government by the Emperor Austria in 1911.

They are being bred for the purpose of obtaining a number of acclimated pedigree rams to be used for crossing with the local or Criolla ewes. In October 1912, 25 dark-fleeced native ewes from Entre Ríos had given 1 to 13 crossbred lambs, of which 9 were males; all the lambs inherited the characters of their male parent with regard to colour and curliness of wool. The experiment was then extended to include 250 ewes brought from different parts of the Argentine, and consisting almost entirely of those with the exception of a few Merinos and Lincolns. The work is being carried out on the San Nicanor estancia belonging to Dr. M. M. Torino, and has resulted in the production of 76 first generation lambs all exhibiting the Karakul fleece; the crossbred ewes will now be repeatedly crossed with the pure Karakul rams until a herd of pure Karakul sheep is obtained. Wet, damp soil has proved very disastrous to the pure Karakul sheep, and has contracted serious parasitic diseases (strongyles, sclerostomi, tricothelium). Of the total number imported in 1911, consisting of 4 rams and 100 ewes, only 5 ewes were alive in 1913. In the course of these two years 100 pure bred lambs were born, of which 8 died; both the first and second generation remained true to type without showing any signs of degeneration.

**Fattening Pigs on Cassava.** — GOUIN, A. and ANDOUARD, P. in *Bulletin des Travaux de la Société Nationale d'Agriculture de France*, Vol. LXXIV, No. 4, pp. 481-483. Paris, April 1914.

The writers, continuing Professor Frateur's experiments in feeding on cassava, made some trials, and found that the method recommended by Professor Frateur might be profitable in Belgium, where cassava is obtainable for 12 or 13 francs per 100 kg. (4s 10d to 5s 3d per cwt.), but it could not be followed in France, where cassava costs 18 fr. the 100 kg. (7s 3d per cwt.).

With a view to finding a more economic use for cassava, the writers made some experiments of their own, with the following results.

1. In the case of pigs fed with milk as well, it only took 3 lbs. of cassava to produce a gain in live weight of 1 lb., instead of the 4.18 lbs. of cassava required at Louvain.

2. By substituting for the milk ration 1.1 lb. of rice gluten and 2 ½ oz. of meal, which costs 1d and is equivalent to 1 gallon of separated milk, it is required, to produce a gain of 1 lb. live weight, only 2.9 lbs. of cassava.

In practice, the profit exceeded 40 per cent.

Professor Frateur fed the cassava to the pigs in slices, cooked and then shredded. The writers fed it raw. It had been previously chopped fine in the colony itself.

655 - **The Influence of the Male Parent on the Character of the Egg-shells, Fowls.** — WALTHER, A. R., in *Landwirtschaftliche Jahrbücher*, Vol. 46, No. 1, pp. 104. Berlin, March 11, 1914.

In an investigation on the heredity of certain characteristics in fowls it was sought to determine to what extent the breed of the cock influenced the weight, shape, gloss and colour of the hens' eggs.

More than 130 eggs were laid by 13 hens, mated, some with cocks of their own breed, and some with cocks of 4 different breeds.

The breeds employed were the following :

*I. Dwarf fowls.*

1. Japanese: 1 cock, 2 hens.
2. Milleseur: 1 hen.
3. Silver-Sebright-Bantam: 1 hen.

*II. Medium-sized fowls.*

1. Huringian "Pausbäckchen": 1 cock, 3 hens.
2. Westphalian "Kruiper": 1 cock, 3 hens.
3. "Nackthälse": 1 cock, 3 hens.

All the dwarf hens were reckoned as belonging to the same race, in view of the difference in weight between them and those of medium size. All the hens were first mated with cocks of their own breed; then the cock was removed and an interval of 8 or 10 days was allowed to elapse before he was replaced by a cock of another breed.

All eggs laid during the first mating period and subsequent isolation are reckoned as pure, while crossed eggs are those laid after the 10th day of the presence of the cock of another breed. Between the removal of the first cock and the time when the second cock's influence began to be felt, a space of time elapsed which the experiment shewed to be long enough to make sure that the influence of the first cock had entirely disappeared. The eggs were weighed and measured, and their colour and gloss noted as soon as possible after they were laid, and particulars were only kept of those eggs which proved fertile on incubation.

The results may be summarised as follows: The fact of the cock belonging to a different breed had no influence upon either the weight, shape, colour or gloss of the eggs. The writer therefore casts some doubt on the recent assertions of Holdefliess and Tschermak, in which the writers allege that they have observed in eggs phenomena indicative of telegony.

656 - **Seaweed for Packing Birds.** — DEKOBRA, M., in *La Nature*, No. 2134, pp. 339-3 Paris, April 18 1914.

In speaking of the utilization of a species of "mutton-bird" the writer describes a new method of packing; this consists in placing the body in a natural bag formed by the lamina of a certain seaweed occurring in islands off New Zealand. Birds can be kept in good condition for several years in this way.

**Ostrich-farming in New Caledonia** — FRAYSE, A. in *Revue de la Chambre d'Agriculture de la Nouvelle-Calédonie*, No. 39. pp. 26-30 Nouméa, March 1914.

A colonist in New Caledonia has started ostrich farming with nine bred birds. The price of the birds was £ 32 a piece, and the total cost of transportation was £ 1000. Ostriches could be had in Australia at a price of £ 40 to £ 48 the pair.

**Poultry-Farming in Canada.** — FORTIER, V. in *La Vie Agricole et Rurale*, No. 16, pp. 434-435. Paris, March 21, 1914.

The writer describes the excellent results achieved for some years now made with the system of unwarmed fowlhouses. Both from the point of view of preventing disease and from that of maintaining the birds in good condition, experience shews that it is better not to heat fowlhouses. Among other good effects this system increases vitality and egg-power. It is sufficient that fowlhouses should be built well protected from damp, and that, at the beginning of the cold season, the fronts should have sacking or coarse cotton drawn over them, so as to keep draughts. The fowlhouse should be built facing south, which greatly increases the temperature inside (when the thermometer outside shews 23° below zero Centigrade, the temperature inside will be 3° or 4° C. on a dry day or 0° to 2° C. on a dull day). The house should be fitted with flat perches, to admit of the fowls covering their feet completely with their feathers. For laying purposes trap-door nests should be used, and should be visited often enough to prevent the eggs having time to freeze. This system has contributed largely to the recent great progress of Canadian poultry farming, the receipts from which have increased, under the encouragement of the Government, from £3 385 000 in 1901 to £7 842 000 in 1911.

## FARM ENGINEERING.

**Automatic Lifter for Balance Ploughs.** — DE CONDÉ, FERNAND in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 113, Vol. 121, No. 1, Paris, January 1914.

1 working with heavy balance ploughs, lifting the shares out of the ground at the end of the furrow is often very laborious. In Bajac's 1 the work is done automatically. In fig. 1 the balance plough is travelling in the direction of the arrow. To the landside of the 1 a sector shaped piece *S* is attached by means of a horizontal axis *x* which it can revolve. While the plough is proceeding, the sector *S* 1 is in the position shown in fig. 1 by a catch. On nearing the end of the furrow the ploughman, without leaving his seat, releases the catch by 1 moving his foot on a pedal, and at the same time he steers the plough so as to bring the wheel *A* on to the unploughed land. The sector then falls 1 into the position *S*, fig. 2, touching the unploughed land with the point 1 *a*. The radius of the curve *ab* of the sector increasing from *a* to *b* causes the point *x* to rise as the machine advances and this, combined with the

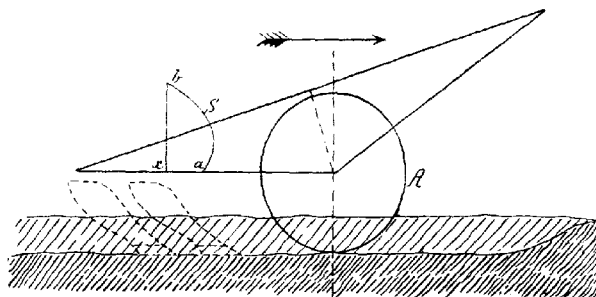


Fig. 1.

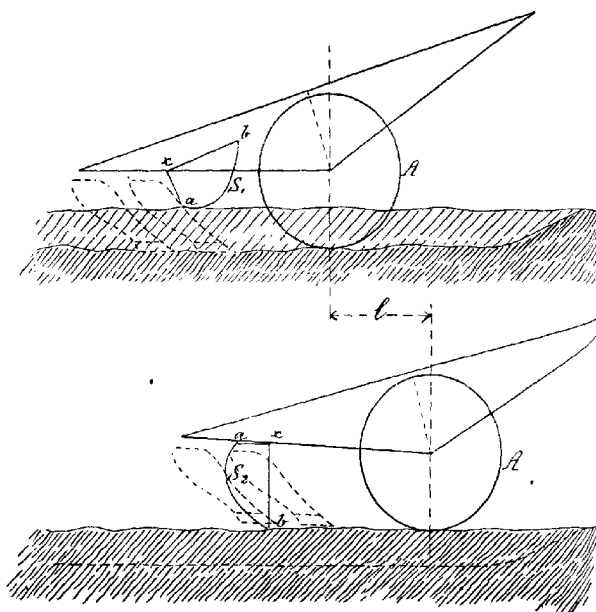


Fig. 2.

of the wheel *A* on the land lifts all the shares out of the ground within a distance equal to the development of the curve *ab*, fig. 2.

In order to prevent the sector slipping or dragging it is provided with projecting cleats.

When the plough is tilted for the return journey the sector is lifted and returned into its original position in which it is caught and fixed by the catch.

**Team-hauled and Self-propelling Motor Binders.** — RINGELMANN, MAX, in *Journal d'Agriculture Pratique*, Year 78, Vol. I, No. 2, pp. 55-57. Paris, January 8, 1914. In order to determine independently the power required by motors working reaping and binding machines, *a*) when self propelled and *b*) when hauled by a team, the writer gives the following data drawn from a series of experiments carried out with various binders working in level ground.

The total amount of work done by a binder in travelling, reaping, binding and overcoming the friction of its mechanism ranges on average

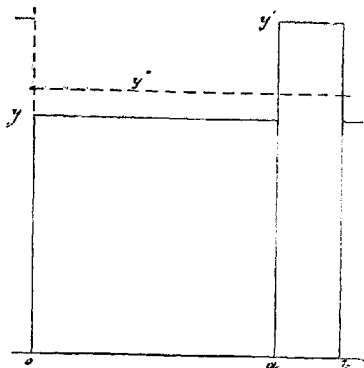


Fig. 1. — Diagram of a cycle of work done by a reaper and binder.

been 656 and 755 foot-pounds per pound of sheaves of wheat, and between 525 and 623 foot-pounds per pound of sheaves of oats.

B. The work of binding a sheaf of wheat weighing 11 lbs. requires an average expenditure of from 330 to 240 foot-pounds, which includes driving the mechanism, packing the cereal, knotting and cutting the twine and carrying the bound sheaf.

C. In machines having a five-foot cutter-bar, working in practice a swath 1.5 to 4 ft. 4 in. on the level, and with a crop of about 44 cwt. of sheaves per acre, the average power varies according to the various phases of work and may be represented by the diagram, fig. 1, in which the distance travelled by the machine is shown by *oa* and *ab* and the power expended by *oi* and *ay*.



1) For a certain space  $oa$  the machine works as a simple reaper-elevator; the average traction  $oy$  is then 343 lbs.

2) At the end of this period there are 11 lbs. of cereals on the deck. The binder gets thrown automatically into gear and works; the machine travels from  $a$  to  $b$  and requires a power  $ay'$ , about  $\frac{4}{5}$

3) The mean for the whole cycle, i. e. for the whole distance  $ob$  is 380 lbs.

But the power required during the two periods is not constant throughout each period. Its variations are shown in fig. 2.

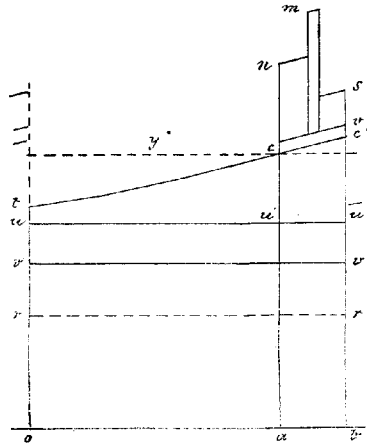


Fig. 2. — Diagram of the variations of power required by a reaper and binder during a cycle of work.

During the first period  $oa$  (when the binder is not working) the following work is done:

or haulage of the machine.

$rv$  power consumed by the various parts of the machine itself as the binder running empty. Everything above the line  $rv$  represents work done in passing the cereal through the various parts of the machine; thus  $vn$  is the work of bending down the grain to the cutter-bar, cutting and carrying it by the platform and elevator canvasses.

$utcu'$  is the work of the packers up to the moment  $ac$  when the enough grain on the deck to throw the binder into gear.

In the second period  $ab$  there are besides these demands, all those at  $cc'$  required by the binder proper, to which must be added  $u''c'$ , or the power which presses the cereal, continually supplied by the elevator canvas, against the back of the needle and the sheaf which is being tied.

$cc'v''$  the working of the binder proper running empty.

the average work of the needle and twine going through the combed sheaf.

the knotting.

cutting the twine after the knot has been tied, the descent of the sheaf and the discharge of the sheaf by the carriers.

The team or the motor have thus to supply during a short time a maximum amount of work shown in *m* in fig 2. In reality the dynamometer readings reveal that in some moments the power required is still greater.

D. Assuming however the average traction required to be represented in figs. 1 and 2, it has been found that a binder weighing, with its gear, about 1700 lbs., cutting a swath of 4ft. 2in. and dealing with a crop of 1 cwt. per acre, requires an average traction power of :

For the haulage of the machine . . . . .	169.4 lbs.
For working the machine running empty. . . . .	90.2 "
For reaping and binding . . . . .	121.0 "
average total	380.6 lbs.

at a speed of 4 ft. per second, corresponds to about 1502 foot-pounds per second or about  $2\frac{3}{4}$  HP.

Taking the above data as a basis and making due allowance for shocks, sudden strains and maximum efforts, the writer calculates that if the binder drawn by a team, the motor required to work the reaping and binding mechanism must be capable of developing not less than 4 HP, while if it also to propel the machine, the motor must be a 14 or 15 HP one, in order to be able to cope with the gradients and inequalities of the ground met with in fields.

**Rubber-testing Machinery at the Imperial Institute.** — *Bulletin of the Imperial Institute*, Vol. XII, No. 1, pp. 76-79, 4 plates. London, January-March 1914.

It has been felt for some time that the present methods of judging the quality of rubber in the sale room are exceedingly crude and unsatisfactory and that accurate data for comparison can only be obtained by careful scientific investigations.

The best and most trustworthy method of judging rubber is to vulcanise a portion and to submit the vulcanised product to mechanical tests. Some work has been done in this direction, but much further investigation is required before the question of the best method of the preparation of rubber can be solved. Recognizing this fact,

Rubber Research Committee of Ceylon, in cooperation with the Department of Agriculture in the Colony, has arranged with the Imperial Institute to conduct a complete investigation of the effect of different methods of preparation on the quality of the rubber.

For this purpose there has been installed at the Imperial Institute a complete experimental vulcanising and testing plant, consisting of a wash-machine, a mixing machine, a three-bowl calender, a vulcanising press, a canising pan, a vacuum drier and a gas-fired boiler, and embodying all the most recent improvements which have been suggested by experience.

For the determination of the mechanical properties of vulcanised rubber one of Schopper's testing machines, which are considered to be among the most efficient, has been obtained. It can be used to determine the breaking strain, the elongation with fixed load, the load required for fixed elongation, etc. The machine is also fitted with an automatic apparatus for drawing diagrams. Other testing machines will be added during the progress of the investigations.

It is anticipated that by these means much light will be thrown on the effect of different methods of preparation on the quality of the rubber, and will enable a method to be selected on the plantations which will produce rubber of the highest possible quality.

662 - **The Motor Plough Trials at Litowitz and at Komotau Hagensdorf.** WIRTH, HEINRICH in *Mitteilungen des Verbandes landwirtschaftl. Maschinen-Fabrik-Anstalten*, Year 8, Part 2, pp. 67-79. Berlin, 1914.

In Austria, where the scarcity of agricultural labour is as keenly felt as in Germany, the question of efficient motor ploughs raises a good deal of interest. Two trials of these machines were held in the autumn of 1913 at Litowitz and at Komotau-Hagensdorf in Bohemia, and their results are given at some length in the above paper, from which the following are taken :

I. *Trial of motor ploughs at Litowitz on medium heavy soil.* - The following firms took part in the trial carried out on September 9 and 10, 1913.

1. JOHN DEERE, with the "Twin City", 45 HP, 4-cylinder direct tractor, 500 to 650 revolutions, and eight-furrow gang plough. Width of land worked 9 ft. 4 in. Price £1250, including eight-furrow plough.

2. I. H. C., with "Mogul", 60 HP, 2-cylinder direct tractor, 350 revolutions, with 1 HP auxiliary motor. Eight-furrow Moline gang plough. Width of work 9 ft. 4 in. Price £1167, including plough.

3. HOFHERR-SCHRANTZ-CLAYTON SHUTTLEWORTH, with "Hart Par", 60 HP, 2-cylinder direct tractor, 300 revolutions, benzol, oil-cooled Deere eight-furrow gang plough. Width of work 9 ft. 4 in. Price £1400.

4. ANTON DOBRY, with a 25 to 28 HP, 4-cylinder direct tractor, Saunderson's system, 550 revolutions; three-furrow Sack plough. Width of work 3 ft. 4 in. Price, £833.

5. ERSTE BOHEMISCH-MAEHRISCHE MASCHINENFABRIK, with the "Praga", contained 32 HP, 4-cylinder motor plough "Praga", 1200 revolutions, five-furrow Joh. Cervinka ploughs. Width of work 4 ft. 8 in. Price £1100, with two sets of ploughs.

6. MÜNCHENER MOTORENFABRIK (Munich-Sendling), with a 30-35 HP, 2-cylinder direct tractor, 480-500 revolutions, five-furrow Fieberhardt plough. Width of work 4 ft 10 in. Price £646.

7. STOCK-MOTORPFLUG-GESELLSCHAFT, with self-contained 42-50 HP, 4-cylinder motor plough, 720 revolutions, six-furrow Stock plough. Width of work 6 ft. 8 in. Price £1104.

8. CASE THRESHING MACHINE CO., with a 40 HP, 2-cylinder direct

	Twin City, 45 HP (25 HP).			Mogul, 60 HP.			
Date: September 1913 . . . . .	9th, a. m.	9th, p. m.	10th, a. m.	9th, a. m.	9th, p. m.	10th, a. m.	
Area actually ploughed, acres . . . .	1.65	2.17	2.06	1.56	3.01	2.27	
Inclination of field in 100 . . . . .	level		9.6	level		9.42	
Fuel, S. G. at 15° C. . . . .	Benzin 0.738			Benzin 0.733			
Net time at work, hours and minutes . . . . .	55 m.	1 h. 25 m.	2 h. 15 m.	48 m.	1 h. 36 m.	1 h. 38 m.	
Depth of furrow, inches. . . . .	6.30-7.09	9.06-9.85	7.88-9.85 (1)	7.09-7.88	9.85 (1)	9.85 (1)	
Breadth of work, inches . . . . .	118.11	87.60	uphill: 59 to 87.6 downhill: 118.11 to 87.6	110.24	110.24	82.68	
Number of ploughs working . . . . .	8	6	uphill: 4 and 6 downhill: 8 and 6	8	8	6	
Speed per second, in feet and inches	3 ft. 5 in.	3 ft. 7	uphill, 4 ploughs 3 ft. 1 downhill 6 ploughs 3 ft. 5	3 ft. 5	2 ft. 10	uphill: 2 ft. 6 downhill: 2 ft. 9	
Calculated averages per acre	Time: hours, minutes . . . .	34 m.	39 m.	1 h. 9 m.	37 m.	32 m. (2)	43 m.
	Fuel, lbs. . . . .	19.34	31.95	—	23.27	27.12	—
	Water for cooling, lbs. . . .	about 5.75			88.84	105.26	—
Performance per day of 10 hours, acres . . . . .	17.54	15.56	8.72	16.30	19.02	14.08	
Estimated average per day of 10 hours, without interruptions, acres	19.76	17.79	—	23.71	19.76	—	

(1) The depth was not constant throughout. — (2) The difference in the time is due to the fact that while ploughing c



	Mogul 60 H.P.		Fort Durr 60 H.P.		Case 40 H.P.		Twin City 45 H.P.		Stack 45-50 H.P.	
Date: September 1923	14th	15th	14th	15th	14th	15th	14th	15th	14th	15th
Area actually ploughed, acres	3-46	2-30	3-62	2-43	3-70	2-47	3-70	2-40	3-70	2-47
Inclination of field	partially slightly inclined	level	partially slightly inclined	level	partially slightly inclined	level	level	level	level	level
Fuel, S. G. at 15° C.	Benzin 0.723	Benzin 0.730	Benzol 0.801	Benzin 0.732	Benzin 0.736	Benzin 0.737	Benzin 0.734	Benzin 0.745	Benzin 0.733	Benzin 0.732
Net time at work, hours and minutes	2 h. 17 m.	1 h. 51 m.	2 h. 42 m.	2 h. 31 m.	3 h. 5 m.	2 h. 39 m.	3 h. 22 m.	2 h. 30 m.	1 h. 43 m.	2 h. 9 m.
Depth of furrow, in.	7-09	9-06	7-49	8-27	5-91	5-52 to 7-88	6-03	8-27	6-70	8-51
Breadth of work, in.	102-36	78-74	53-54	54-72	57-09	50-39	57-09	53-54	80-71	55-51
Number of ploughs working	7	6	4	4	4	4	4	4	6	4
Speed per sec., ft. in.	2 ft. 11	2 ft. 4	3 ft. 3	2 ft. 11	3 ft. 3	2 ft. 4	3 ft. 7	3 ft. 1	4 ft. 9	3 ft. 2
Calculated averages per acre:										
Time, hours and minutes	40 m.	49 m.	45 m.	1 h. 12 m.	50 m.	1 h. 4 m.	38 m.	1 h. 2 m.	28 m.	52 m.
Fuel	29-4	23-55	46-56	44-60	25-42	30-06	32-47	40-59	22-30	23-99
Water for cooling lbs	158-78 (1)	91-88	oil cooling		5-35	12-58	4-73	8-30	2-99	3-12
Performance per day of 10 hours	15-14	12-35	13-49	9-63	11-98	9-34	15-56	9-71	21-49	11-51
Estimated average per day of 10 hours, without interruptions	16-05	12-35	13-58	11-11	12-35	?	13-58	10-37	21-49	11-61

(1) At each stoppage some water was lost.

tractor, 450 revolutions, Deere six-furrow plough (Inlands type). Width of work 7 ft. 6 in. Price £925, including 6-furrow plough.

All the above machines are provided with differential gear to enable the wheels to revolve independently of each other in turning, and with reversible motion. To prevent skidding most of the engines are fitted with fixed or removeable projecting cleats, besides fixed or removeable iron wheels to enable them to drive other machines. They are all easy to steer.

The object of the competition was to ascertain the amount and quality of the work done, and to this end a large field was divided into eight adjoining plots of the same shape and size, one for each machine. The first day the ploughing was done on the level, in the morning to a depth of 6 inches, in the afternoon to about 10 inches. The next day (September 10) the ploughing was done on an inclined field. September 9 was a fine sunny day but in the night 0.16 in. of rain fell.

On the first day a wheat and barley stubble was ploughed; the soil was a medium loam, dry on the surface. Each of the ploughs was given 5 acres to plough. The data obtained are given in Table I, and from these the work done per hour and the consumption per acre of fuel and of water for cooling were calculated. In consulting these figures, however, it must be borne in mind that the conditions were not all invariably the same throughout the tests. Thus in the morning the tractors on reaching the end of the furrow lifted the shares out of the ground and returned running empty, while in the afternoon they ploughed all round. Further, in the afternoon several of the outfits reduced the number of ploughs in the gang. The depth of furrow was not the same in all cases. There may also be some errors in the observations, which tell all the more as the duration of the trials was short. As for the quality of the work, the turning over of the soil was good throughout, with the exception of the "Praga" plough which in shallow ploughing was not satisfactory. Uniformity of depth was attained better by the direct traction ploughs than by the self-contained ones. The loosening and crumbling of the soil was sufficient in all cases, with the exception of the "Praga" in shallow ploughing. Observations were also taken of the appearance of the ploughed land one week after the tests and after a rainfall of 2.2 in.

On the second day, September 10, the field to be ploughed was a wheat stubble, medium loam and sloping towards the south, the gradient being about 9 in 100. To each outfit 2.47 acres of land were assigned. The work done was similar to the deep ploughing of the preceding day. The ploughing in of the stubble was not quite satisfactory, nor was the loosening of the soil, especially in the case of the heavy tractors, which compressed the soil. "Praga", "Stock" and "München-Sendling" crumbled the soil very well. The traction ploughs required two men each, the self-contained ploughs only one.

II. *Trials at Komotau-Hagensdorf (on very heavy soil).*—On September 14 and 15, motor plough trials took place on Herr E. Harsch's estate at Hagensdorf near Komotau. The machines entered were the following: International Harvester Co's "Mogul" (60 HP); Hofherr-Schranz-Clay

Littleworth's "Hart Parr" (60 HP); Case Threshing Machine Co's 40 tractor plough; John Deere's "Twin City"; and Stock's motor

On both days barley stubble was ploughed; the heavy humous clay in good condition with regard to moisture. On September 14 the soil was quite the same for all the machines, the I. H. C. plough getting the best, the Stock the lightest and the others occupying the same intermediate positions as in Table II. On September 14, each machine was given 3.7 acres in extent, on the 15th 2.47 acres. The resistance of the soil the second day was very nearly the same for all plots.

The competing machines were to have ploughed to a depth of 6 inches the first day and 10 inches on the second. On both days the ploughing of the stubble and turning over of the soil, as well as the loosening of the soil, was satisfactory. The data concerning the performance of the machines are given in Table II (p. 925).

**A Self-Steering Farm Motor.** — WASHBURN, H. J. in *The Scientific American*, Vol. CX, No. 15, p. 313. New York, April 11, 1914.

A great need of the country is an efficient helper for the owner of the farm, a machine that will work effectively and make him less dependent upon hired help, while saving him a considerable outlay in

Such a system has been devised on a practical basis. It requires a machine with certain conditions which cannot be fulfilled on all farms, which are an easy matter in some existing ones and in many new ones.

The farm must contain one or more circular areas of any size up to 10 acres each, reasonably level.

Thus a 10-acre farm would have a 7-acre circle in its centre, the remaining 3 acres in extent, being occupied by fruit trees, buildings, etc. In the centre of the circle the post shown in the figure (facing p. 928) would be recently erected. At the top of this post, which is strongly guyed, is a heavy iron drum. This drum is set and locked by the handle on the side of the post. Attached to the drum is a slender galvanized steel wire; it passes through a guide pulley and then to the steering lever of the motor-implement at some distance away. At each revolution of the implement around the field the wire wraps once round the drum, hence the circumference of the drum determines the width of work done. Between the frame of the steering lever of the implement a strong spring is attached, tending to pull the implement away from the centre post. The steering wheel has a flange in order to resist side pressure. About two pounds pressure at the end of the steering lever is sufficient to guide the implement. The tension of the spring and of the wire opposing it is about 50 lbs., the steering lever is obliged to follow an exact spiral path.

The machine runs with the implement, starting at a radius of about 10 ft. and finishing about 20 ft. from the post, showed no visible variation in its course. The steering action was very dependable, requiring no attention whatever.



The framework of the implement is intended to be such as will facilitate the attachment of all the devices used in row-crop farming, such as plowridgers, cultivators, sprayers, etc.

An improved style of implement has been designed, having motive power applied to both rear and forward wheels, both of them being pivoted as to work between closely set rows of plants. The height under the wheels is about 3 feet, permitting the cultivation of tobacco, cotton, etc., of any height. A safety device is provided to stop ignition in case of breakage of steering spring or wire. With a dependable motor two six-hour runs a day without an attendant are possible.

664 - **Foundations on Explosion Piles in Compressible Soils.** — BEAUMONT, J. *Revue Industrielle*, Year 45, No. 12, pp. 155-158. Paris, March 21, 1914.

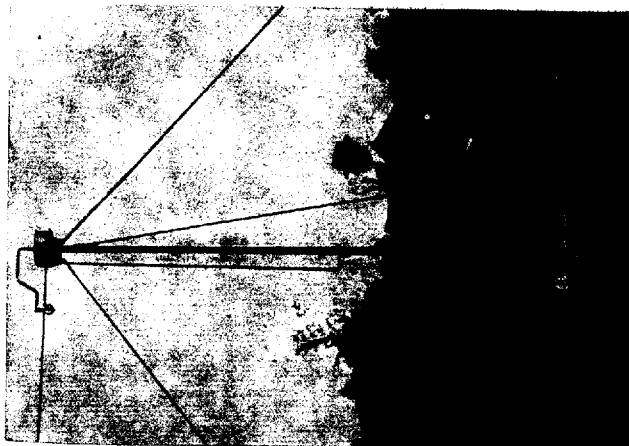
Compact and resistant soils allow the foundations of buildings to be laid directly upon them, but such soils are rarely found at the surface; they are generally situated at varying depths and frequently so low down as to be practically beyond reach. In these cases recourse is had to: 1) a continuous simple or reinforced concrete foundation; 2) timber or concrete piles rammed by a pile driver; 3) concrete piles built on the spot.

The first system can be adopted only where the load to be borne is moderate and uniformly distributed and where there is no danger that the ground will be disturbed or undermined; it is, besides, expensive. Timber piles, among other drawbacks have that of being conical in shape and provided with a pointed iron shoe, both of which conditions tend to make them sink deeper into the ground under the weight of the building. If, on the other hand, they reach a sufficiently resistant layer they are liable to break under the blows of the ram and thus to become useless. The same defects are met with in the concrete piles driven in by ramming and these are still more apt to break than the timber ones. Further they require at least three months to set before being used and they are expensive.

Wherever possible it is therefore an advantage to use concrete piles built where they are to stand, and to replace their pointed extremity by a base much larger than the rest of the pile. With the explosion pile a large bearing surface is obtained together with an artificial compression of the surrounding soil which greatly increases its resistance. These piles are made as follows: a special steel tube encasing a timber pile is driven into the ground to the required depth by means of a pile driver. The timber pile is then withdrawn and the explosive cartridge is let down to the bottom of the hole in a special patented apparatus which has the object of protecting it and of directing the force of the explosion in a horizontal direction. The steel tube is then filled with fresh cement concrete (fig. 2) and lifted about 3 ft. 3 in. from the bottom (fig. 2), after which the charge is fired. The concrete sinks instantly and fills the chamber formed by the explosion (fig. 3). All that then remains to be done is to pour concrete into the tube, raising the latter gradually, and at last to remove it altogether and the result is an explosion pile with a large and resistant base surrounded by, and resting on, strongly compressed ground (fig. 4).



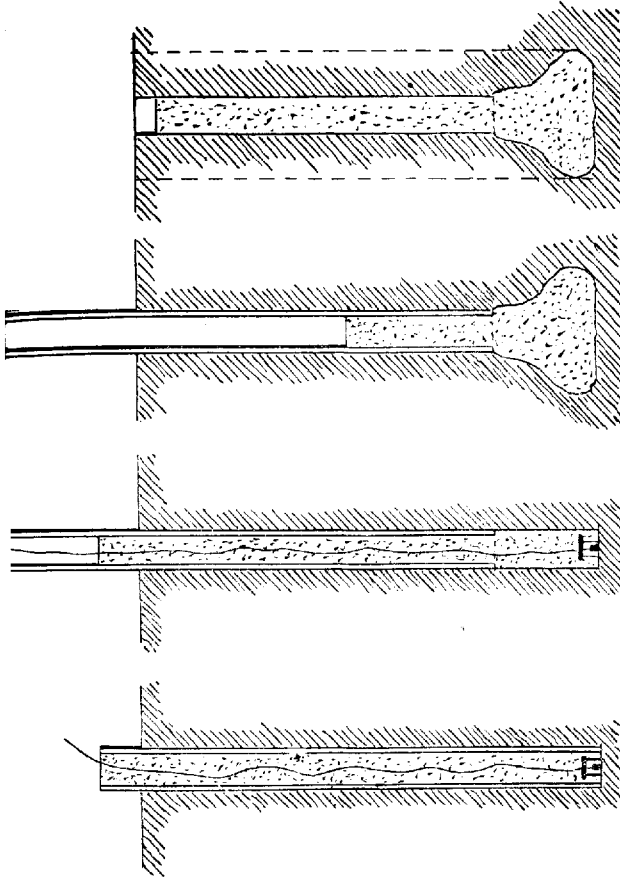
Explosion pile taken out of the ground



Centre post for self-acting farm motor.



There is no difficulty in regulating at will the size of the foot of the pile and the compression of the ground around it. The cubic contents of the pile chamber caused by the explosion are easy to calculate, being equal to the



difference of volume of the concrete in the steel tube before and after the explosion. Thus after a few trials the most suitable charge can be determined. It should be noted that with these piles the foundation is not repre-

sented only by the cross section of the pile, but by the section of the whole heterogeneous cylinder of earth and concrete shown by the dotted lines in fig. 4. If the soil is very bad and the load considerable, several of these piles can be grouped together, in which case the soil around their bases gets so compressed as to approach the hardness of concrete. Fig. 4 (facing p. 928) taken from a photograph of one of these explosion piles.

### RURAL ECONOMICS.

665 - **The Economic Limit of Sugar-Beet Growing.** — BERNARD, P. in *Le Progrès agricole*, Year 28, No. 1392, pp. 229-230 and No. 1393, pp. 249-250. Amiens, March 2 and 29, 1914.

One of the most important factors influencing the profitability of sugar-beet growing is the cost of transport, which depends principally upon the distance the beet has to travel on its way to the factory.

The writer determines the outside limit of this distance at the price now ruling in France. He endeavours first to ascertain the cost of the "mile-ton" of beets. In a farm of 494 acres consisting of:

Wheat . . . . .	118.5 acres
Other cereals . . . . .	59.0 "
Beets . . . . .	118.5 "
Clover . . . . .	59.0 "
Meadows . . . . .	99 "
Lucerne . . . . .	40 "

on a 6-year rotation, the carting is as follows:

	Horse-days	Weight carted
Farmyard manure for beets . . . . .	432	1 417 tons
Lime and artificials . . . . .	25	83 "
Liquid manure to the meadows . . . . .	64	165 "
Cereal harvest . . . . .	114	566 "
Haymaking, clover . . . . .	33	165 "
" meadow . . . . .	20	98 "
" lucerne . . . . .	150	492 "
Carting sugar beets, mangolds and their leaves . . . . .	792	5 197 "
Carting cereals to railway . . . . .	30	110 "
Total . . . . .	1 660	8 293 tons

If the average distance of this carting be taken at 2 kilometers (1.2 miles) this farm has to provide for 10 283 mile-tons in 1660 horse-days. The farm requires 4690 horse-days for all the agricultural work of the farm, and as the total cost of the upkeep of the necessary teams amount to £1011, the cost of carting 10 283 mile-tons is  $\frac{1011 \times 1660}{4690} = £357 \text{ } 16\text{s. } 2\text{d.}$

for one mile-ton  $\frac{357 \cdot 16 \cdot 0}{10 \text{ } 283} = 8.35 \text{ } d.$  If instead of 2 kilometers, 1.5 kilometer (0.9 mile) be taken as the average distance of the carting, other conditions being equal, the cost of transport per mile-ton amounts to 1. The writer therefore considers that he is not far wrong when he assumes

average cost of transport for a beet farm at 0.60 fr. per kilom.-tonne per mile-ton).

The average cost of production of sugar-beets per acre is calculated as follows:

	£	s	d
Rent . . . . .	1	5	8 ½
Interest on capital invested, at 4 % . . . . .	—	9	0
Farmyard manure, 40 tons, of which ½ are debited to the beets . . . . .	2	11	2
Artificial . . . . .	2	14	7 ½
Preparing the soil before sowing . . . . .	1	0	10 ½
Value of seed and sowing . . . . .	—	14	5 ½
Hoeing and singling . . . . .	1	2	6
Lifting and loading . . . . .	—	19	3 ½
Sundries . . . . .	—	8	0
Total . . . . .	£11	5	7 ½

To this cost of production the cost of carriage has to be added. If the crop be estimated at 11.94 tons per acre (30 tonnes per ha.), it means weight of 15.13 tons has to be carted to the factory on account of 17th adhering to the beets. At a cost of 9.81d per mile-ton, the cost of transport amounts to  $9.81d \times 15.13 = 12s\ 4d$  per mile. Thus the following has been drawn up, showing the profit or loss per acre of beets grown, according to the distance between the fields and the factory, when the sale of the beets is 22s 3¼d per ton.

Distance from fields to factory	Cost of carriage			Total outlay per acre			Profit (+) or loss (—) with an income of 22s 3¼d × 11.94 = £13 6s p. acre		
Miles	£	s	d	£	s	d	£	s	d
1	—	12	4	11	17	11 ½	+	1	8 0 ½
2	1	4	8	12	10	3 ½	+	15	8 ½
3	1	17	0	13	2	7 ½	+	3	4 ½
4	2	9	4	13	14	11 ½	—	8	11 ½
5	3	1	8	14	7	3 ½	—	1	1 3 ½
6	3	14	0	14	9	7 ½	—	1	13 7 ½

The point at which beet growing no longer pays lies at a distance between 5 and 6 miles from the factory. One means of extending this limit is the granting of indemnities for carriage, proportional to the distance, as is already being done by the Meaux sugar factory. The substitution of mechanical for team haulage would also lower the cost of carriage; 10 HP motor lorries, whose performance would amount to 48 132 miles in 300 days, would work at a rate of 1.96d and 2.42d per mile-ton respectively. As the lorries would only have to deal with 10 302 mile-tons could therefore be utilized during only a limited part of the year, these would have to be increased, but even if they were doubled a considerable saving over team haulage would be effected.

666 - **Work and Wages of Foreign Labourers in Prussia.** — GROSSMANN in: *Land- und Forstwirtschaftliche Zeitung*, Year 7, No. 28, p. 248. Königsberg, April 4, 1914.

The foreign labourers who come for the season are generally on piece work at hoeing, harvesting, cutting green crops, pulling, or lifting potatoes. The following are the most usual wages.

	I. With partial board : potatoes, milk and bread				II. With full board			
	Beets		Mangolds		Beets		Mangolds	
<b>A. Hoeing.</b>								
1. Per acre of roots:								
a) First hoeing . . . . .	3s	2d	2s	4d	2s	4d	2s	4d
b) Hoeing between the rows . . . . .	2	4	2	4	2	0	2	0
c) Singling . . . . .	4	0	3	2	3	2	3	2
d) Second hoeing . . . . .	4	0	3	2	3	2	3	2
e) Third hoeing . . . . .	4	9	3	2	4	0	3	2
2. Per acre of potatoes. . . . .		4s		0d		3s		2d
3. Per acre of grain . . . . .		4s		0d		3s		2d
4. For work after the horse-hoe the above prices are diminished by 9d per acre . . . . .								
<b>B. Cutting green crops and harvesting.</b>								
1. Reaping winter grain, per acre . . . . .		4s		9d		2s		4d
2. Binding, stooking and carrying winter grain, per acre . . . . .		4		9		1		7
3. Reaping spring grain, per acre . . . . .		2		4		2		0
4. Binding, stooking and carrying spring grain, per acre . . . . .		2		0		1		7
5. When working after a reaping machine the above prices are diminished by 4d per acre . . . . .								
6. Mowing meadow grass, clover, lucerne, serradella or lupins, per acre . . . . .		2		4		1		10
<b>C. Pulling roots.</b>								
	Beets		Mangolds		Beets		Mangolds	
1. Roots: Pulling, topping, heaping, clamping, and covering clamps . . . . .	22s	6d	14s	3d	19s	0d	12	0
The same after a root-lifting machine . . . . .	19	0	11	0	16	0	9	0
2. Roots: Pulling, topping, heaping, and either building small clamps for carting or loading on carts . . . . .	19	0	9	6	16	0	8	0
The same after root-lifting machine . . . . .	16	0	8	0	12	9	6	0
3. Covering the clamps with earth to a depth of 12 inches, according to the nature of the soil; per running foot . . . . .		7	8d	to 1		7	8d	to 1
4. Pulling swedes, as at C2, per acre . . . . .		9s		6d		8s		0
<b>D. Potatoes.</b>								
1. Digging, per 110 lbs. . . . .		2		1/2d		1		3/4d
2. If preceded by the potato-plough, the price is reduced by 1/2d per 110 lbs. . . . .								

**Cost of Production of Milk and Beef.** — WATERSTADT, F. in *Archiv für exakte Wirtschaftsforschung*, Vol. 6, Part 1, pp. 137-156. Jena, 1914.

The writer reports certain results of observations made on the cost of production of milk and of meat, and discusses the factors which influence values in the various systems of farming. In one Table (see Table I) he selects the most important results from seven dairy farms where the cows raised no stock of their own (Abmelkwirtschaften) and from seven where they only raised a portion (Halbabmelkwirtschaften). These are placed in ascending order of cost of milk production.

TABLE I. — *Results from 7 Dairy Farms where none of the stock was raised and from 7 where some of it was raised.*

No. of Farm	Per Cow per Farm					
	Cost of feeding M.	Labour M.	Gain or loss of flesh M.	Total expenditure M.	Gross return M.	Cost of producing 1 gallon of milk pence
<i>Farms where no stock was raised.</i>						
.....	531.2	60	— 1	702	718	6.2
.....	512	60	+ 1	641	677	6.7
.....	534	58	— 39	695	684	6.9
.....	472	57	— 45	634	620	7.0
.....	533	57	— 42	682	654	7.25
.....	538	53	— 50	703	669	7.6
.....	530	55	— 120	768	683	8.4
Average . . .	521	57	— 42	689	673	7.2
<i>Farms where some of the stock was raised.</i>						
.....	310	58	+ 16	427	475	5.3
.....	316	58	+ 19	446	465	5.8
.....	347	65	— 5	468	466	6.2
.....	414	58	— 4	553	548	6.4
.....	389	65	— 32	550	544	6.9
.....	420	53	+ 13	548	468	7.3
.....	437	68	— 32	593	507	8.0
Average . . .	376	61	— 9	512	496	6.6

It is seen from Table I that on dairy farms where none of the stock is raised, in spite of the increased cost of milk-production, the cost of feeding and labour bills are very little changed. On the other hand it is clearly seen that unfavourable results (*viz.* excessive cost of milk-production) are connected with the difference between the cost-price and the sale-price



of the cows. In the case of the dairy farms where a portion of the stock is raised, the chief factors influencing the cost of milk-production are the increasing cost of feeding and the milk-yield.

The results from nine dairy farms where the stock is raised on the premises are collected in Table II.

TABLE II. — *Results from 9 Dairy Farms where the stock is raised on the premises*

Farm	Milk yield gallons	Gross return	Gain (+) or loss (—)	Cost of production, pence per gallon	Sale price, in pence per gallon
		£.	£.		
A . . . . .	616	723	— 113	10.4	6.3
B . . . . .	670	642	— 36	9.6	7.25
C . . . . .	653	580	— 59	8.5	5.9
D . . . . .	722	661	+ 3	6.9	7.0
E . . . . .	724	672	+ 58	6.3	6.6
F . . . . .	736	661	+ 58	5.4	5.7
G . . . . .	788	891	+ 67	6.2	6.6
H . . . . .	425	365	— 51	10.25	5.5
I . . . . .	434	540	— 186	13.2	5.5

The three first farms shew a deficit, a result attributable to the cost of milk-production. Whether a farm pays depends also on the yield, as appears from a comparison of the figures for B with those for C. This interpretation is confirmed by the results from the other farms, of which four, having high milk-yields, realize a profit. The last farms experience a loss, due to their poor milk-yield. The cost of production has also its significance with reference to cost of production. The farms D and F, the gross returns are the same and yet the cost of production is very dissimilar. The writer lays stress on the fact that the four farms where a profit was realized the feeding requirements had been very accurately calculated, the individual rations carefully controlled according to Kellner's tables, and their cost ascertained in each case.

In the second part of his work, the writer gives results from 100 pasture farms for 1909 and 1910. These results are given in ascending order of the number of head of stock carried per acre of pasture. It will be noticed that the number of head per acre has a marked influence on the gross yield of the pastures, as well as on the net yield and on the cost of production. The last farm, which in 1910 carried 1.6 head of stock per acre, seems to have been overstocked. The gross yield was no higher, the net yield was lower, and the cost of production went up.

TABLE III. — *Results from Pasture Farms in 1909-1910.*

Head of cattle fed per acre	Gross return per acre of pasture s.	Net return per acre of pasture s.	Cost of producing 1 lb. live weight d.	Net return per acre for the whole farm s.
0.30	38	7	6.7	— 11
0.72	86	66	2.7	+ 30
0.74	88	20	5.0	21
1.13	141	87	3.2	62
1.41	152	109	2.5	29
0.45	35	— 11	9.1	11
0.62	88	43	3.2	35
0.65	66	38	4.0	25
0.66	54	39	3.5	39
0.78	92	55	3.2	56
0.83	96	55	—	25
0.95	123	90	3.2	8
1.62	120	59	3.7	62

According to Strebel's calculations, the cost of rearing a 2-year-old ox is about £26 and the cost of producing 100 lbs. live-weight is about 11s. in raising young stock.

The writer's investigations on the cost of production in fattening cattle produced the results given in Table IV.

TABLE IV. — *Cost of Production of Fattening Cattle.*

	I 1908-11 Average d	II 1908-11 Average d	III 1909-12 Average d	IV 1907-10 Average d	V 1906-11 Average d
Per head per day:					
Material expenses . . . . .	1.55	1.55	1.52	1.56	1.65
Labour . . . . .	1.2	0.7	1.1	1.0	0.9
	s d	s d	s d	s d	s d
Raising . . . . .	2 8	2 5	1 5	2 10	2 6
Outlay . . . . .	4 0	3 7	2 7	4 11	3 11
Feeding . . . . .	1 1	1 1	1 0	1 11	1 3
Cost of production per 100 lbs. live weight . . . . .	35 7	32 10	40 4	47 6	40 4

The great influence of the cost of feeding and of the difference between cost-price and sale-price in rendering the fattening of cattle profitable or unprofitable should be noted.

Finally, the writer gives the results of Howard and Lehmann's researches on the cost of fattening pigs. The average cost of production varied from 37s 6d to 40s 6d per 100 lbs. live-weight.

**668 - The German Imperial Commission of 1912-13 on the Cattle and Meat Trade.**

1. *Verhandlungen der Gesamtkommission und Zusammenstellung der Sachverständigen Gutachten*, XVI + 468 pp. — 2. *Anlagenband I: Sachverständigen-Vernehmungen*, II + 99 + 107 + 131 + 103 + 80 pp. — 3. *Anlagenband II: Materialien*, IV + 375 + 11 tables. Berlin, 1913.

In 1912 the German Government set up a Commission of 30 members for the purpose of enquiring into the condition of the cattle and meat trade. The Commission held a preliminary sitting on the 22nd of November 1912 to discuss the scope of the enquiry, and subsequently, up to the 20th October 1913, sat on five occasions, each sitting occupying two days, to consider the evidence of 165 experts, including representatives of farmers, cattle-dealers, butchers, cattle valuation societies, and various towns all parts of Germany. Representatives of the Imperial Government and of the Governments of the different Federated States also took part in the discussions.

The following questions in particular were considered at the various sittings: the determination of the price paid for beasts sold to the butcher; the question of dealers; the slaughter of immature calves; credit in relation to the cattle-trade; dealers' and slaughterers' commissions; the meat trade; meat-selling by stores, shops, and industrial enterprises; long-term contracts; experience with foreign meat, and municipal meat-buying boards for fixing the price of meat; estimation of prices; organization of information and statistics.

The entire proceedings of the Commission, including the evidence of the experts and the material furnished by the investigations, were collected at the Imperial Ministry of the Interior and published in the three volumes under notice.

We here give only a few results of enquiries made by the Sub-Commission on the relative price of fat stock on the farm and in the market. At some endeavours to make a direct enquiry as to farm prices by general investigation in the country districts, the Sub-Commission soon came to the conclusion that the only way to obtain an accurate idea of the difference between the price on the farm and that in the market was to ascertain from a series of fat stock markets the sale prices of a large number of beasts in the country and the expenses entailed by them between then and their sale in the market. On these lines, therefore, thorough enquiries were made at the markets in Berlin, Dresden, Breslau, Hamburg, Munich, Frankfurt-on-Main, Mannheim and Cologne. The whole of the material collected was then arranged in such a way that for each individual purchase the following particulars were ascertained:

1. The price in the country, *i. e.* the sum paid to the farmer.

TABLE I.  
Sundry expenses (in marks per head), for cattle sold by dealers.

I Markets	II Transport	III Gratuities	IV Insurance	V Commission on sales	VI Expenses of marketing	VII Total expenses of marketing of cattle IV VI	VIII Total expenses of sale IV VI	IX Loss in weight	X Total expenses VIII + IX
<i>Hs and Steers:</i>									
lin. . . . .	11.12	1.11	7.05	6.40	6.42	19.86	31.98	15.85	47.70
esden (1) . . . . .	11.62	1.50	7.73	11.87	6.82	26.42	38.44	13.47	52.57
eslau . . . . .	6.95	1.95	5.04	5.48	4.02	13.63	21.38	—	—
mburg . . . . .	8.21	0.30	4.08	9.62	3.07	16.81	25.00	17.44	42.81
nich (1) . . . . .	7.24	1.00	4.32	2.77	2.54	9.36	16.96	—	—
ankfort (1) . . . . .	7.32	1.67	—	6.35	1.83	4.55	12.76	—	—
unheim (1) . . . . .	5.37	2.50	—	6.26	2.81	8.58	14.91	—	—
ogne (1) . . . . .	5.65	2.50	3.00	—	1.76	4.35	10.01	—	—
<i>Hs:</i>									
lin. . . . .	11.53	1.83	8.75	7.27	5.25	21.27	33.92	14.30	49.35
eslau . . . . .	6.99	1.50	6.00	4.33	4.11	13.44	21.93	—	—
mburg . . . . .	8.46	—	8.04	8.68	2.93	21.01	29.47	—	—
<i>Hs and Sheep:</i>									
lin. . . . .	2.85	0.50	0.75	1.88	1.41	3.47	6.65	2.26	6.04
esden . . . . .	1.83	0.50	0.20	1.45	2.03	3.68	5.75	1.14	6.89
eslau . . . . .	0.76	0.50	0.50	0.54	0.70	1.74	3.00	—	—
mburg . . . . .	1.00	—	0.10	1.20	0.70	2.00	3.00	—	—
nich . . . . .	2.09	—	—	1.22	0.75	1.97	4.06	—	—
ogne . . . . .	3.57	—	—	1.30	2.00	3.30	6.87	—	—
<i>Hs:</i>									
lin. . . . .	3.65	—	1.00	1.98	2.10	5.08	8.73	6.98	15.70
esden . . . . .	2.19	—	0.80	1.92	2.48	5.20	7.39	6.93	13.92
eslau . . . . .	1.47	0.75	1.00	1.38	2.25	4.63	6.85	—	—
nich . . . . .	2.50	—	—	0.55	0.65	1.20	4.50	—	—
ankfort . . . . .	—	—	—	1.10	1.25	2.35	3.00	—	—
unheim . . . . .	2.52	—	0.80	1.43	1.15	2.27	4.78	—	—
ogne . . . . .	2.59	0.30	0.60	1.73	2.51	4.41	7.07	—	—

1) Cattle in general.

## TABLE II.

*Sundry expenses (in marks per head) for cattle sold by co-operative societies*

	I	II	III	IV	V	VI	VII	VIII
	Transport	Expenses of the Co-op. Society and of insurance during transit	Insurance	Commission	Market expenses	Total market expenses IV-VI	Total expenses of the sale II-VI	Loss in weight
<i>1. Cattle:</i>								
Berlin . . . . .	10.70	2.91	7.09	7.56	4.88	19.53	31.78	—
Hamburg . . . . .	7.32	1.50	4.09	8.93	3.83	16.68	22.38	—
Munich . . . . .	3.13	0.50	3.38	3.58	3.47	10.43	12.87	—
Frankfort . . . . .	—	1.42	—	6.00	8.50	14.50	15.92	—
Mannheim . . . . .	8.45	1.50	5.00	6.04	3.63	14.68	24.13	—
Cologne . . . . .	1.78	—	3.00	4.39	4.68	11.32	23.0	—
<i>2. Calves:</i>								
Berlin . . . . .	1.74	1.98	0.70	1.48	1.40	3.58	7.30	—
Dresden . . . . .	1.81	1.63	0.20	1.58	1.40	3.18	6.62	—
Hamburg . . . . .	1.16	0.28	0.30	2.45	1.12	3.87	4.27	—
Munich . . . . .	1.01	0.46	0.20	1.07	0.77	2.03	3.24	—
Frankfort . . . . .	—	—	—	1.40	1.45	2.85	2.85	—
Mannheim . . . . .	2.80	1.00	1.00	1.52	0.37	2.89	6.69	—
Cologne . . . . .	—	—	—	1.30	1.95	3.25	—	—
<i>3. Pigs:</i>								
Berlin . . . . .	2.99	1.57	1.00	2.35	1.82	5.17	9.33	—
Dresden . . . . .	3.90	1.42	0.80	2.59	2.75	6.14	11.46	—
Hamburg . . . . .	0.95	0.36	0.60	1.25	0.65	2.50	3.06	—
Munich . . . . .	1.82	0.78	0.31	0.85	0.69	1.84	3.05	—
Frankfort . . . . .	—	0.40	1.00	2.28	1.03	3.41	3.79	—
Mannheim . . . . .	1.85	1.00	1.00	1.81	0.81	3.62	6.00	—
Cologne . . . . .	—	—	0.60	1.37	2.03	3.37	—	—

2. The price in the market, *i. e.* the sum paid by the purchaser.

3. The incidental expenses of the deal.

4. The gain or loss to the dealer.

From these it was discovered that a large majority of the transactions enquired into, at the markets mentioned, resulted in a loss to the dealer by reason of a fall in the price of fat stock. The average sale-price per kg. (220 lbs.) live-weight for cattle (bulls, steers, cows and heifers) did

exceed the purchase price in the country by more than about 5 to 10 marks (1), while in the case of smaller stock (especially pigs) this excess in some cases reached as much as 40 marks. The purchase-price of cattle per 100 kg. generally varied between 90 and 100 marks (45s to 50s per cwt.) and the sale price between 95 and 110 marks (47s to 54s 9d per cwt.). The purchase price of calves and pigs was mostly near 120 marks per 100 kg. (60s per cwt.) and the sale-price averaged about 140 marks (70s per cwt.) and there was a rise above 160 marks (80s per cwt.). The incidental expenses may be seen from Tables I and II.

It was further found that the price on the farm is governed by the price in the market, and not vice versa, and that consequently the farm price may be reckoned by deducting the incidental expenses from the market price.

If this method of calculation does not always lead to exact results, the reason is to be sought in the great distance often intervening between purchase in the country and the sale in the fat-stock market, and in the fact that the irregular supply at the markets exercises a great influence on the prices. It has hitherto been impossible to regulate the supply to the markets, and thereby to eliminate its price-raising influence. If the stock have been sent down by a glut on any market, the farmers refuse, because of the low prices, to sell their stock to the dealers. The result is that the next markets are only feebly supplied and the prices rise again. Thus great oscillations are observable in the price of fat stock, and these exercise an unfavourable influence on the cattle-trade generally. This unfavourable influence on prices is not exercised by native selling at the fat-stock markets, because in this case the fluctuations of the market recoil immediately upon the producer, who thus obtains a smaller profit and cannot afterwards seek to recoup his direct loss, as the dealer does, from the next market.

**Book-keeping Competition for Small and Medium-sized Farms in East Prussia.** — *Georgine*, Year VII, No. 40, Königsberg, May 16, 1914.

The East Prussian Chamber of Agriculture has organised its third book-keeping competition for holders of small and medium-sized farms. Competitors are limited to holders of not more than 100 hectares (247 acres), who must keep the books themselves or entrust them to a member of their household. The accounts must cover a whole year's operations and must include:

1. A cash account, *i. e.*, a record of all incomings and outgoings, household and farm expenses being kept as distinct as possible.
2. A household account with a careful record of all goods furnished to the farm.
3. An inventory containing a valuation of buildings, and live and dead stock at the beginning and at the end of the period under consideration.
4. A balance sheet.

1) The Mark is about 11 3/4d, or 23.86 cents.

The total value of the prizes amounts to 500 marks (£ 25). They are awarded by a special committee made up of members of the County Rural Economics and Book-keeping of the Chamber of Agriculture. All the figures communicated by competitors will be treated as strictly confidential.

### AGRICULTURAL INDUSTRIES.

670 — **Results obtained by the Distribution of Pure Hungarian Yeast Cultures in 1912.** — REGINYI, G. in *A. m. Kir. Ampelológiai Intézet Évkönyve* (Bulletin of the Royal Hungarian Ampelological Institute), Vol. V. pp. 36-39. Budapest, 1912.

One of the most important functions of the zymological section of the Royal Hungarian Ampelological Institute consists in collecting yeasts from the best wine-producing districts of Hungary, for the use of the growers in wine making. This work was begun in 1901; the yeasts were taken from the lees of young wines and from the sediments of old wines. By 1906 it was possible to commence the selection of primary cultures, that is to say the founding of pure cultures of each kind, starting in each instance by inoculation with a single cell. This was a tedious process, having regard to the enormous number of species which exist (2), and particularly because it was always essential to regard the matter from a practical standpoint, and to endeavour to obtain species which exhibit qualities of value for wine making. The aim in studying individual species was to determine:

1. How far yeasts will ferment must of normal composition under conditions of varying temperature ( $24^{\circ}$  to  $25^{\circ}$  and  $6^{\circ}$  to  $12^{\circ}$  C.), and must containing 35 per cent. of sugar.

2. Their power of resisting sulphur.

3. Their vitality, strength and power of forming sediment.

In fact, all the morphological and physiological characteristics may serve toward the exact classification of the species. The number of primary cultures obtained from the material collected was 976. The study of these cultures produced 73 species, and after subsequent selection, and elimination of species of no marked value, 54 species were successfully defined and are preserved in a dilute solution of saccharose, presenting the Ampelological Institute's "Collection of Species"; although all the species ferment must of normal composition, each one presents specific characteristics and advantages, suitable for use under special conditions, e. g. the production of sweet wines, champagne, membrano growth, etc.

(1) It is important that the yeasts should be collected from the lees, as this ensures obtaining those which have produced the fermentation of the wine, while those found in the wine itself are the yeasts which take part in the after-fermentation.

(2) From 1901 onwards, 341 divisions have been made, producing 73 species, from yeasts collected in the Tokaj district (*Bulletin of the Royal Hungarian Ampelological Institute*, No. 1, p. 56. 1908).

ter being carried through the experimental stage, the pure cultures were offered to vine-growers; 24 vine-growers asked for samples of in 1911, and this number increased to 152 in 1912 and 230 in 1913. Growers were supplied with application forms in which they stated working details, and the yeasts best corresponding to the growers' needs were sent to them, soaked on to cotton-wool, together with instructions for the use of the yeasts.

The following were the results of the experiments made in this way among growers in 1912 (1):

1. In 65.6 per cent. of the fermentations carried out by the growers, the inoculation of the must was a complete success. The fermentation, clarification, and maturing of the musts treated in this way were effected more speedily and, in the majority of cases, the fermentation in value was estimated at an average of from 5 to 7 crowns per hectolitre (2 *d* to 3 *d* per gall.).

2. In 21.9 per cent. of the cases, the flavour of the wines showed markedly increased development, but by reason of the quicker and more fermentation, this development was also more speedy, and the clearing-off easier.

3. In 12.5 per cent. of the cases only, no difference was noted in the produce of the inoculated must and that of the control.

Generally, the fact should be emphasized that in no case was an adverse effect reported.

The smaller growers worked with from 1 to 20 hl. (22 to 440 galls.) at, while the others carried out their experiments with 50 to 300 hl., to 6 500 galls.) The total quantity of must inoculated during the experiments may be reckoned at 2300 hectolitres (50 600. galls.).

**Hybrid Wines at the Toulouse Exhibition, 1914.** — PÉRE-LABY in *La Vie Agricole et Rurale*, Year 3, No. 21, pp. 581-585. Paris, April 25, 1914.

Exhibitions of wines from direct-bearer hybrid vines have been held for the first time now at Toulouse. Of the 60 white wines exhibited in 1914, the following proved the best: Cirere No. 157; Seibel Nos. 880, 4151, 3013 (resistant to mildew), 2563, 3021, 2663. Seibel Nos. 2859 and 2677 produced good rose wines. All the varieties mentioned above are entirely free from oidium (powdery mildew). Among the Malègue hybrids, the following were classed as "good": 469-2, 1157-1, 1063-7, 1647-8, 1879-12, 1609-3, 2328-1 and 2401-4; their resistance to mildew (*Plasmopara*) has not yet been sufficiently ascertained.

The quality of the wines exhibited in 1914 was on the whole better than in 1913. The writer comes to the conclusion that, at a comparatively low cost, white wines could be produced from the above hybrids, which could be consumed alone or blended with other wines or with each other. Some of them could quite well compete with the ordinary French white

) The results for the 1913 trials cannot yet be published, as the necessary data, the analyses of the wines, etc., are not yet complete.



wines, and some, according to the verdict of the judges at the show, with the better types.

Of the 120 red wines exhibited, the following deserve special mention as general blending wines, the less delicate wines among the Seibel hybrids are noteworthy, namely 128, 156, 1020, 1077, 2003, 2007. The following newer hybrids produced quite good, but perhaps rather less full colour wines: Seibel Nos. 1007, 2052 and 877, Couderc 4401, Le Madone Couderc 286-68. The following wines were of a very fine red colour, a good aroma, a delicious flavour, and plenty of fire: Malègue 22 2054-7, 2161-2, 2359, 1539-22, 2271-1, 2055-15, 1583-21, 391-6, 2046-8 and 469-9. For the four last-named, two sprayings form a sufficient protection against mildew, while the others have not yet been sufficiently tested. The following wines, with a normal red colour, are also worth mentioning: Seibel Nos. 1000, 60, 4004, 3011, Bertyle-Seyve 413, Baco 1, 11, 2046-8 and 469-9. The exhibition of red wines shews: 1) that excellent blending wines can be obtained from red hybrids; 2) that many red wines of normal colour, can be used for consumption just as they are. The hybrid blending wines are also very useful for improving the colour of pale coloured French wines grown from European vines, or for improving red wines by adding more body to them, on account of their higher content of alcohol and dry-extract. Some of the red wines could even compete according to the show judges, with some of the better kinds of European wine.

A special section of the Exhibition was devoted to purely blending wines, and the fact was observed that certain of the hybrid wines, which were unfit for use by themselves, gave quite good results when mixed with other better wines, or even with wines of no great worth in themselves. Some mixtures of good wines far surpassed either of the components taken individually. This group of blending wines gave rise to the following observations: to improve red hybrid wines no French white wines of European vintage are needed, because the white hybrid wines, which cost less, answer the purpose perfectly. For this reason, according to the writer, every vine grower who only grows hybrids ought to cultivate, as well with his red kinds, enough white hybrid wines to enable him to improve the quality of his red wines and give them a higher market value. The mixing of certain red wines with one another produces in many cases also a good result, as was proved by various wines at the show. The greater the number of kinds of wine mixed (and this applies to red wines alone as well as mixed red and white), the better the result tastes. Hybrid wines with "foxy" or "grassy" taste (wines that come from hybrids of *Lincecum*) should be mixed with hybrid wines which will mask this flavour, and wines having merely a raspberry flavour can, if required, be used alone.

**Influence of Chloroform and of Oil of Mustard on the Alcoholic Fermentation of Grape-Must.** — KLOSS, in *Zeitschrift für Gärungsphysiologie*, Vol. IV, Part 3, p. 185-193. Berlin, April 1914.

In order to preserve a sample of unfermented must for the purpose of fitting it subsequently to chemical analysis, chloroform or oil of mustard is sometimes added.

As a result of experiments on the action of these substances on ferments in the fermentation of grape-must, the writer found that by adding 1 cc. chloroform to 500 cc. of must, sterilized and inoculated with pure cultures of yeasts, the fermentation was arrested, but the multiplication of the yeasts was not entirely checked. Must inoculated with pure cultures of yeast 12 days old only fermented slightly and for a short time. With 6-day-old cultures the must did not ferment at all. This yeast thus showed itself less resistant than the older culture. At the end of the experiment the older yeast cells had for the most part died out, while those of the 12-day-old yeast, though deprived of glycogen, survived for the most part, and, when introduced into ordinary non-sterilized must, fermented it, which was not the case with the former cells.

Oil of mustard has a much more vigorous action, seeing that even 3 drops in 500 cc. of must checked not only the fermentation, but also the multiplication of the yeast. All the yeast cells were dead at the end of the experiment.

A second series of experiments was undertaken with non-sterilized must in various stages (fresh-pressed, slightly fermented and highly fermented). In this case also, oil of mustard was the more effective, 10 drops of must being enough to arrest the fermentation completely, a quantity which was not achieved even on adding 2 cc. of chloroform. The action of chloroform seems to have checked the multiplication of this yeast more in this experiment than in the preceding.

A further experiment proved that the development of *Penicillium* was arrested by 5 cc. of chloroform or by 14 drops of oil of mustard per litre of must.

**Co-operative Distilleries in the Pays de Caux, France.** — BERTRAU, PIERRE, in *Comptes-Rendus de l'Assemblée Générale de 1914 de la Société des Agriculteurs de France*, pp. 653-656. Paris, May 15, 1914.

In the Pays de Caux, where the soil is remarkable for its fertility and produces wheat and sugar-beets well, the small size of the holdings places a considerable difficulty in the path of establishing industries requiring a large outlay of capital on the part of agriculturists.

It is due to the activity of the Director of Agriculture for the Seine-Inférieure that co-operative distilleries have been formed. Of these there are at present four, situated at Raffetot, Anneville-sur-Scie, Fauville and Vyetot, all definitely co-operative in character. The distillery at Raffetot, which has the fewest members, comprises 16 producers and covers 310 acres of beets. All these establishments employ exclusively sugar-beets grown by their members. The latter, on the other hand, undertake to deliver to the distillery under the best possible conditions

all the sugar-beets they grow, and to put every year to beets a minimum area determined for each farm. The capital amounts to £2 660 at Raffen, £3 560 at Anneville, £3 000 at Yvetot, and £3 200 at Fauville, each divided into £2 or £4 shares. The balance of funds required is advanced by the State, through the district Treasury of Upper Normandy, in the shape of a loan, as laid down by the Act of 29 December 1906.

The seed for the beet crops is distributed to members by the distillery, and deducted from their share of the profits at the annual settlement of accounts. The roots, when pulled, are sent to the factory, weighed and tared under the usual regulations, and the pulp is returned to the owners, in proportion to the weight of roots supplied. This pulp is taken back at half a crown per ton.

The administration of the Society is in the hands of a Board made up of at least 10 of the members, which superintends and controls the commercial undertakings of the Society. At the end of each season it divides the proceeds from the sale of the alcohol among the members in proportion to the quantity and sugar-content of the beets contributed by each of them. Two deductions are first made to cover repayment of the capital and the State loans.

The plant is, for the most part, on the Wauquier diffusion system made to deal with from 60 to 70 tons of roots a day, at 6 degrees density producing a very strong phlegm (92 at the least). The Anneville distillery is the only one fitted with Egrot machinery.

At the end of the first season at Yvetot, each member received an average of £41 10s per acre or £1 6s 5d per ton of beets.

674 - **Potato-drying Works in the German Empire in 1908-09, 1909-10, 1910-11.** *Vierteljahrshefte zur Statistik des Deutschen Reiches, Ergänzungsheft zu 1913, III:1. Ergebnisse der deutschen Produktionshebungen*, p. 76. Berlin, 1913.

In the following statistics the year commences on August 1 and ends on July 31.

During the three years 1908 to 1911 the potato-drying works in activity were respectively 170, 254 and 327. Of these 114, 167 and 216 were attached to farms or other agricultural undertakings; 40, 65 and 94 were cooperative concerns (among which those having the form of joint stock and limited liability companies and the like are included); 7, 9 and 10 were independent undertakings and 9, 13 and 10 were attached to independent industrial concerns.

In the 170, 254 and 327 works, 170, 254 and 331 drying plants were at work. Among these, 140, 208 and 270 were cylinders; 22, 36 and 27 were drums; 7, 9 and 6 were of the hurdle type and 1 was a press. As sources of heat, 143, 209 and 273 used steam and 27, 45 and 58 the products of combustion. Some of the works, namely 82 in 1908-09, 143 in 1909-10 and 181 in 1910-11, worked with day and night shifts of 12 hours each.

The following table gives further details concerning the works and their produce.

	1908-09	1909-10	1910-11
number of works . . . . .	170	254	327
of works that use peeled potatoes :	6	8	4
above, strips and slices are made in . . . .	3	5	1
" flakes . . . . .	3	2	2
" flakes and meal . . . . .	—	—	1
" strips, slices and meal . . . . .	—	1	—
of works that use unpeeled potatoes :	164	246	323
above, strips and slices are made in . . . .	25	39	52
" flakes . . . . .	133	197	260
" crumbs . . . . .	2	2	2
" flakes and meal . . . . .	3	5	3
" flakes and crumbs . . . . .	1	1	1
" flakes and strips . . . . .	—	—	1
" strips and meal . . . . .	—	—	4
" strips and groats . . . . .	—	1	—
" strips, slices and groats . . . . .	—	1	—
	tons	tons	tons
quantity of potatoes treated . . . . .	157 483	327 053	410 624
the works themselves . . . . .	147 200	286 735	369 003
potatoes produced by the works . . . . .	97 775	184 320	267 227
" from other sources . . . . .	49 424	102 415	102 268
" produced in the country . . . . .	48 795	99 725	99 384
"      " abroad . . . . .	629	2 690	2 884
outsiders . . . . .	10 643	40 318	41 621
amount of dried product per annum . . . .	40 875	86 119	105 507
the works themselves, total . . . . .	38 024	75 478	94 780
strips and slices . . . . .	5 243	11 512	10 340
flakes . . . . .	31 154	62 267	83 112
meal . . . . .	1 484	1 438	1 028
crumbs and other products . . . . .	143	262	201
outsiders . . . . .	2 851	10 640	10 732
strips and slices . . . . .	1 115	4 168	3 872
flakes . . . . .	1 736	6 378	—
flakes and meal . . . . .	—	—	6 860
other products . . . . .	—	94	—
products made by the works for themselves .	38 874	71 431	95 755
themselves . . . . .	10 069	17 889	21 308
strips and slices . . . . .	1 805	3 916	4 982
flakes . . . . .	8 176	13 852	16 131
meal . . . . .	—	—	61
crumbs and other products . . . . .	875	115	135
others, in the country . . . . .	27 363	52 072	73 958
strips and slices . . . . .	3 366	5 637	5 847
flakes . . . . .	—	—	67 118
flakes and meal . . . . .	23 942	46 333	—
meal and crumbs . . . . .	—	—	943
crumbs and other products . . . . .	55	107	—
others, abroad . . . . .	1 441	1 465	488

- 675 - **The Value and Use of Millet Malt.** — HÉRICUS-TÓTH, J. VON and OSZTROMA A. VON (Royal Hungarian Distillery Experiment Station, Gödöllő) in *Kísérleti közlemények*, Vol. XVII., No. 1, pp. 35-44 + 2 plates. (Summary in German, p. 45) Budapest, January-February 1914.

Millet malt has the same value as barley malt. In malting the difference is in the steeping: millet may stay in the vat until it has absorbed its full amount of moisture by alternate steepings and exposures to the air, or it may afterwards take up the moisture still required by being sprinkled. In the first case the grain is steeped for 5 to 7 days; during the process it increases in weight by 35 to 50 per cent.

The disadvantages of millet are its extraordinarily high content of dirt, grass seeds and grains that do not germinate; also it is frequently covered with smut (*Ustilago destruens*). It is advisable to clean it before washing it. The really floating grains are not easy to recognize.

In order to prevent the formation of mildew, the steeped grain should be daily ventilated once or twice. The temperature in the sweating should be kept below 30° C. (86° F.). The best temperature for malting is from 18° to 23° C. (64° to 73° F.). Lower temperatures lengthen the operation without other inconvenience. The sprouting grain is heaped up to a depth of 8 to 12 inches and gradually reduced to 4 in. It is advisable to wash the malt when ready.

In comparison with other grains, the production of the necessary diastatic enzymes takes place with loss of matter. The saccharification and liquefaction capacity, according to Effront and Lintner, are smaller than in barley malt, but greater than in maize or oat malt. In brewing, millet has some very valuable properties: it prevents frothy fermentation; the ratio between the maltose and dextrin formed, the final fermentation, and the production of alcohol are good. Probably in the various grains the structure of the saccharification enzymes is the same, and the cause of the lower Effront and Lintner values does not lie so much in the greater lesser capacity of producing enzymes as in the want of an agent (co-enzyme, etc.) to increase the diastatic power of the various kinds of starch over pure and soluble starch. This agent is, however, contained in sufficient quantity in the various raw materials used in the mashes. With the analytical method, according to which less malt is taken than is required for the saccharification of the mash, the differences in the results become apparent. The curve of the formation of diastase in millet resembles that of maize; after attaining the highest value of diastatic power it sinks rapidly.

- 676 - **The Influence of the Fat Content of Milk upon the Rapidity of Coagulation.** — KREIDL, ALOIS and LENK, EMIL in *Biochemische Zeitschrift*, Vol. 63, Parts 24-25, pp. 151-155. Berlin, May 28, 1914.

In estimating the coagulating power of rennet, it is generally accepted as a law that the quantity of ferment used multiplied by the time required to obtain coagulation is a constant. This law is, however, modified by numerous factors, such as temperature, neutral salts, lime-precipitates, alkaloids and more especially by the previous treatment of

The writers have shown that the rapidity of coagulation of a milk could be so diminished that often after 24 hours no coagulation had yet taken place. When, however, a non-sterile rennet or an aseptically sterilized milk was used, coagulation immediately set in. The writers also observed that when previously treated milks containing different amounts of fat received the same quantities of rennet, coagulation did not take place at the same time.

These experiments were recently repeated by the writers with five different milks containing respectively 1, 3, 10, 16 and 30 per cent. of fat. The milks were placed in test tubes kept at 40° C. (104° F.) in a water-bath.

A fresh 1 per cent. neutral filtered solution of Grüber's rennet was used.

Every five minutes the test tubes were taken out and examined for changes in the milk; all five were examined at the same time.

In the first experiment, in which 1 cc. of rennet solution was added to 10 cc. of each of the undiluted milks, no difference in the rapidity of coagulation was observed. In the next experiment, in which each of the milks was diluted with 50 per cent. of water, it was found that the lower the fat content of the milk, the more rapid and complete was the process of coagulation.

**Purification and Disposal of Waste Water from Dairies.** — DORNIC, DAIRY  
VIGNEROT, in *Annales de la Science Agronomique*, Year 33, No. 4, pp. 150-170,  
Paris, April 1914.

The waste water from dairies cannot be allowed to flow into streams, or the subsoil without first being purified. In France, the Act of 1902 imposes on local authorities the obligation to make bye-laws dealing with the question in their districts. Another Act, at present in course of preparation, is to deal with drainage into non-navigable rivers.

The process of purification employed varies naturally with the position of the waste water, which in its turn depends on the type of drainage carried on in the dairy. From this point of view dairies may be divided into four classes:

1. Dairies which receive milk from farms and forward it on to towns, either with or without pasteurizing. These dairies produce a volume of waste water equal to half the milk dealt with, and proceeding chiefly from the cleaning of cans, machinery and receiving platforms.
2. Dairies where the milk is used for making cream, butter and cheese, where the whey is returned to the farmers, after the casein has been separated. Such dairies use a volume of water about equal to the amount of milk dealt with.
3. Dairies where pig-fattening is practised. These have to dispose of a volume of water about 2 to 2½ times that of their milk.
4. Dairies which extract the casein from the whey and discard the whey with the waste water. In these the outflow of water is double the volume of milk dealt with. This class is tending to disappear, as pig-rearing is becoming more economical, seeing that pig-rearing pays 2d to 2½d per gallon for whey with the casein removed, which is wasted in dairies.

of this class. Besides, the waste water from them can only be purified by a biological process, which is exceedingly long and troublesome.

The composition of the waste water from a given dairy varies with circumstances and the individual dairies. The range of possible variation is given in Table I.

TABLE I. — *Composition of waste water in mgm. per litre.*

	Water in which milk-cans have been washed (Kattein and Schoofs)	Bömmers	Calmette	Daire (water from butter factory)
Capacity for oxidation in mgm. of potassium permanganate per litre . . . . .	754.7	126 to 4076.4	—	550 to 1000
Organic nitrogen . . . . .	24.5	7 to 118	43.6 to 115	15 to 100
Organic substances . . . . .	300.7	253 to 2733	1550 to 2135	215 to 1000
Fatty substances . . . . .	from 159 to 290	—	628 to 1440	80 to 1000
Milk-sugar . . . . .	—	traces to 731	—	traces to 100

The waste water decomposes quickly, especially in summer, and gives off a foul smell due to the putrefaction of the casein and the albumin matter. The milk-sugar is not present in a large enough quantity to be harmful, and besides, the acid fermentation which it undergoes would rather tend to delay proteolytic fermentation. Fatty matter decomposes very slowly. The chief object to aim at, therefore, is the reduction of casein, and as this substance decomposes fairly rapidly, prompt action is required.

There are three different kinds of processes of purification: chemical processes, biological processes, and the filter-bed method. The last is most suitable in the majority of cases. A chemical process recently invented by Daire seems to have a great future before it, and is described below in detail.

*Chemical processes.* — Considerable reduction of the nitrogenous matter in the waste water from cheese factories has been obtained with the aid of the following substances (Table II):

TABLE II. — *Reduction by chemical means of the nitrogenous matter in the waste water from dairies.*

Reagents	Percentage of nitrogenous matter removed
Aluminium sulphate + lime . . . . .	69.6
Perchloride of iron + lime . . . . .	67.5
Ferrous sulphate + lime . . . . .	25.8
Ferric sulphate + aluminium sulphate + lime . . . . .	67.5
	75.3

reduction in bacterial content was also obtained by adding 2.3 gm. of sulphuric sulphate per litre to water containing organic matter, but this is, in addition to being more expensive than the foregoing, gives a residue which cannot be turned to account.

Hamilton's method, though extremely ingenious, unfortunately scarcely admits of application to commercial use. It is carried out by means of masonry reservoirs. In the first of these the water is heated for 24 hours by means of a coil; a part of the albuminoids is precipitated by butyric and acetic fermentations. In the second, thick lime wash of sodium silicate is added; calcium silicate is formed, and carries off albuminous matter in solution. The precipitate may be used as a manure, and the clean water can be drained into a river.

Daire's new chemical process, in use at the co-operative dairy at Cour d'Aunis (Charente Inférieure) requires the following plant: *a*) a circular decanting-basin, of about 350 cu. ft. content, in which decantation is effected by a system of outlet pipes flush with the level of the deposits in the basin; *b*) a filter basin made of reinforced concrete, 6 ft. across and 12 in. deep, containing a bed of coarse slag, covered over with a layer of turf; and *c*) various accessories (a cement gutter, a pump and a tank for waste water, a stirrer, etc.); the whole costing about £80.

The process is as follows: First, calcium superphosphate ( $6\frac{1}{2}$  lbs. per cu. ft. of water to be treated), is spread over the bottom of the basin; the waste water is forced into the basin as fast as it is produced; when it is all in, milk of lime (which must not contain carbonate) is thrown into the basin, in just sufficient quantity to neutralize the phosphoric acid. In practice, it can be seen when this quantity has been reached by the liquid in the basin turning pink. An excess must not be given or albuminous matter will be dissolved. During the operation, stirring takes place by means of a stirrer consisting of a perforated iron disc on a long handle. When stirring is complete, it is allowed to remain for 3 hours at least, after which the clear liquid is decanted and the deposit sent to the filter basin. It is convenient to arrange for the filtration to take place at night. The operation must be performed once in 24 hours.

This process, which has given complete satisfaction for a year at Cour d'Aunis, is cheap, requires only a small amount of labour and makes use of easily obtained and inexpensive materials (superphosphate, lime and turf).

The turf manure taken from the filter basin undergoes very active fermentation owing to the presence of the lime, and exhibits the composition given in Table III.

TABLE III.

*Composition of turf manure from filter basins (average of 14 analyses).*

Water . . . . .	80.2 %
Organic nitrogen . . . . .	0.38 "
Inorganic " . . . . .	0.27 "
Mineral substances . . . . .	5.85 "
Phosphoric acid ( $P_2O_5$ ) . . . . .	0.77 "



It will be noticed that this manure contains as much nitrogen phosphoric acid as farmyard manure. Its value is therefore considerable and in fact easily repays the cost of setting up the plant.

*Biological processes.* — Anaerobic fermentation in septic pits is suitable for dairies of the first three classes. For water rich in serum, the plant is complicated and costly, in addition to which the standard of intelligence obtaining among persons engaged in the dairy trade makes the method somewhat inapplicable. Oxidation in bacteria beds may be continuous or intermittent, the former being the more perfect. Water rich in serum requires previous neutralization and a more complex plant. Purification by irrigating growing crops is the most economical method and is the one to employ wherever there is a large enough area and a sufficiently porous soil. Stagnation must be avoided, and too much water must not be allowed to soak into highly porous soil, for fear of polluting the underground water supply. Suitable crops for receiving such irrigation are forage crops, osier beds and vegetables.

678 — **The Activity of Cooperative Dairies in Hungary in 1911-12.** — Extract from the Statistical Yearbook on the activity of the Hungarian Government, published in *Volkswirtschaftliche Mitteilungen aus Ungarn*, Year IX, No. 2, pp. 194-196, Pest, February 1914.

At the end of 1912, 528 cooperative dairies were working, or 20 per cent. more than at the end of 1911. Of these

335	or 63 per cent.	were founded in 1896-1905
121	» 23	» » » in 1906-1910
40	» 8	» » » 1911
20	» 4	» » » 1912
12	» 2	» » » before 1896

Comparative data for the years 1911 and 1912 are given in the following table.

	1911	1912
No. of members <sup>1</sup> . . . . .	57 436	55 777
No. of cows registered . . . . .	97 658	91 513
Total amount of milk received . million galls. .	21.5	22.8
Av. annual yield per cow . . . . . galls. .	220	250
Produce sold :		
Whole milk . . . . . million galls. .	6.92	9.25
Cream . . . . . galls. .	255 000	300 000
Butter . . . . . metric tons (1) .	2 100	2 400
Cheese . . . . . » » .	1 869	2 103
Other produce . . . . . » » .	10 200	1 700

During 1912, 57 of the dairies received Government grants amounting to £3086, fourteen received grants from local authorities and four received grants from other sources.

(1) 1 metric ton = 0.9842 long ton.

**Review of Beef Production in the United States.** — MUMFORD, H. W. and L. L. D. — *University of Illinois Agricultural Experiment Station, Circular, No. 169*, 1-28. Urbana, Ill., September 1913.

The fattening was first practised in the United States at the beginning of the last century. Starting in the State of Ohio it gradually extended over Kentucky, Indiana and Illinois, while at the same time the industry spread northward from Texas over the great western plains. In the second half of the century, after the Civil War, an increased demand for beef in the East together with improved facilities for cattle export stimulated the production, and the industry gradually extended northward with the building of the railways and the introduction of the motor car. The cattle census per decade is given in Table I, together with the ratio of cattle to the population.

I. — *Number of cattle per decade and ratio of cattle to population.*

Year	Total cattle	Cattle other than milch cows	Increase in total cattle, per cent.	Total cattle, per capita	Cattle other than milch cows, per capita
1800	25 000 000	15 000 000	—	0.64	0.39
1810	33 000 000	21 000 000	+ 32	0.66	0.42
1820	53 000 000	37 000 000	+ 60	0.84	0.59
1830	68 000 000	45 000 000	+ 28	0.89	0.66
1840	62 000 000	41 000 000	— 10	0.67	0.45
1850	58 000 000	37 000 000	— 7	—	—

The number of cattle increased up to 1900 and then decreased, but the decrease shown in 1910 is in reality less than would appear from the figures, as the census in that year was taken on April 15 instead of on June 1, which has been the customary date previously, and it is estimated that 5 to 6 calves are born between those two dates. Even making allowance for this, the decrease is significant, especially when considered in relation to the increasing population. A natural consequence of the decline has been the diminution of the surplus available for export, as shown in Table II. The absolute numbers and percentages of the various classes of cattle in 1910 are given in Table III together with the average value of the calves of the different classes.

The first two-thirds of the cows of breeding age are designated as dairy cows, the remainder being kept mainly for raising beef calves, and the dairy cows are worth almost \$12 a head more than the beef cows. The ratio of the value of adult steers to cows and heifers is 1 : 1.46.

TABLE II. — *Surplus of cattle available for export.*

Year	Value of all cattle other than milch cows	Value of exports of beef cattle and beef	
		Absolute	Relative
	\$	\$	per cent
1870 . . . . .	290 491 000	2 693 000	0.9
1880 . . . . .	341 761 000	31 544 000	9.2
1890 . . . . .	560 620 000	53 170 000	10.0
1900 . . . . .	689 486 000	68 407 000	9.8
1905 . . . . .	661 571 000	72 435 000	10.9
1908 . . . . .	845 938 000	55 466 000	6.6
1910 . . . . .	917 453 000	24 400 000	2.7
1912 . . . . .	790 064 000	14 602 000	1.8

TABLE III. — *Cattle classified by age and sex, 1910.*

	Number	Percentage	Av. value per head
			\$
Calves born after Jan. 1, 1910 (under 3 1/2 months) . . . .	7 806 539	12.6	61
Steers and bulls born in 1909 (3 1/2 to 15 1/2 months) . . . .	5 450 289	8.8	25
Steers and bulls born before 1909 . . . . .	7 598 258	12.3	14
Heifers born in 1909 (3 1/2 to 15 1/2 months) . . . . .	7 295 880	11.8	22
Cows and heifers not kept for milk, born before 1909 . . . .	12 023 682	19.5	34
Cows and heifers kept for milk, born before 1909 . . . . .	20 625 432	33.4	20
Unclassified . . . . .	1 003 786	1.6	
Total . . . . .	61 803 866	100	

The geographical distribution of the cattle other than milch cows April, 1910 was as follows:

North Atlantic States . . . . .	2 130 000
South " " . . . . .	3 029 000
North Central " west of the Mississippi . . . .	12 320 000
" " " east " " . . . .	4 990 000
Southern and Gulf " . . . . .	10 786 000
Far Western " . . . . .	7 925 000
Total . . . . .	41 180 000

the North Central States and the region including Oklahoma and contain the largest number of cattle, the so-called "corn belt" States, Indiana, Illinois, Iowa, Missouri, Nebraska and Kansas -- accounting most one-third of the total number. Moreover, as large numbers of are yearly brought into the "corn belt" to fatten, it is estimated that the total beef produced in the United States comes from that district. Two-thirds of the cattle are west of the Mississippi, while two-thirds of the cattle are east of the Mississippi, there is an enormous movement of fat from west to east to supply the demand for beef in the more densely settled districts, and this movement has brought about the establishment of the great cattle markets at Chicago, St. Louis, Kansas City, etc. Large central markets slaughter about half the total cattle in the United States. In 1903 the distribution of slaughtered cattle was estimated as follows:

	Head
At large central markets . . . . .	6 570 000
In other cities of over 50 000 inhabitants . . . . .	930 000
In cities and villages of under 50 000 inhabitants . . . . .	3 500 000
On farms and ranges . . . . .	1 500 000
Total . . . . .	12 500 000

Further, in that same year, 520 000 head were exported alive, bringing total number marketed for slaughter up to 13 020 000 head, of which 10 000 head or 45 per cent. were killed by six companies known as the packers".

**Arrangements for the Carriage of Agricultural Produce by Rail in France, especially on the Paris-Lyon-Méditerranée Co.'s System.** — BOUSIGUES in *Bulletin mensuel de l'Office des Renseignements agricoles*, Year 13, Nos. 2 and 3, pp. 194-201 and 300-320. Paris, February and March 1914.

The writer deals with the chief arrangements made by all the French railways for improving the carriage of agricultural produce. He describes the stores and the perfection of the rolling-stock on the State railway, the fixing of tariffs for milk by the Est Co., the fitting of vans for mushrooms, bananas, beets and pulp on the Nord, and the various arrangements made by the Paris-Lyon-Méditerranée to encourage the trade in fruit, early vegetables and flowers. The last-named will be dealt with here.

From the agricultural point of view, the P. L. M. system is particularly favourable to the natural resources of the districts it serves ensure a heavy traffic in the seasons: cereals in Brie, Beauce, Limagne and Lower Burgundy; wines in Burgundy, Franche-Comté, Auvergne, Languedoc and Provence; store crops in the Charolais and the Nivernais; early vegetables and olives in Provence; oranges and flowers on the Riviera; fruit and vegetables in the valleys of the Saône, Rhône and Durance. The Company also deals with the produce from Algeria, Tunis and Morocco.

Table I shows the progressive increase in the food-products carried by goods trains.

TABLE I.  
*Carriage by slow goods trains on the P. L. M. (metric tons)*

Goods	1912	1911	1910	Difference 1912-1910
Wine . . . . .	2 629 000	2 366 000	2 655 000	— 26%
Flour . . . . .	1 023 000	1 085 000	964 000	+ 59%
Cereals . . . . .	2 335 000	1 727 000	1 525 000	+ 510%
Fruit, vegetables, milk, etc. . . . .	950 000	955 000	921 000	+ 29%
Hay, straw . . . . .	677 000	568 000	543 000	+ 134%

The P. L. M. Co. has made special efforts to increase the traffic fruit, early vegetables and flowers by express train; for this purpose trains have been speeded up and the best possible conditions arranged. Table I shows the amounts of these goods carried by express service.

Besides the ordinary post-trains, the Co. runs eight or ten special trains for perishable goods daily; their average speed is 40 m. p. h., so that the run from Marseilles to Paris (536 miles) is done in 22 to 24 hours and that from Avignon to Paris (458 miles) in 18 to 20 hours; these times include unavoidable stoppages as well as the collecting at the various departure stations.

In 1911 this organization was completed by special arrangements at Chasse, a Station 13 miles south of Lyons on the left bank of the Rhône.

*Arrangements at Chasse station.* — The station is on the Paris-Venise line, and is the junction for three branches: Lyons-Nîmes by the right bank of the Rhône; Roanne-Lyons, via St. Etienne; Paray-le-Monial-Givors. Goods can be sent to Paris and England by three routes: St. Etienne-Lozanne or Dijon; to the Est Ry. via Dijon Is-sur-Tille; to Germany via Bourg-Besançon - Belfort; to Switzerland via Ambérieu-Geneva.

The vans passing through Chasse number 60 000 yearly; the packages are rearranged so as to make up whole trains requiring no shunting other than the dividing up at junctions; in this way 6000 vans are liberated. The Chasse station is informed by telegraph of the composition of the trains arriving, and has a practised staff who put right irregularities in packing and examine the labelling. The compensation for loss, delay and damage paid on the Paris markets, has been reduced to 156 000 fr., or 1.51 fr. (about 1s 3d) per ton.

The P. L. M. Co. has also arranged with the Nord and Est Cos. and the German State railways for through fast services; these allow perishable goods to arrive in excellent condition on the markets in London, Berlin, Cologne, Frankfurt-on-Main, etc. The times are as follows:

Avignon to London . . . . .	37 hours
Avignon to Frankfurt-on-Main . . . . .	39 "
Avignon to Berlin (Anhalt sta.) . . . . .	57 "

TABLE II.

(1) 1 metric ton = 0.9842 long ton.

The Company has 2847 fast vans (type H. P.) ; these are well ventilated ; the walls and roof are double, with an air-jacket, so that delicate goods keep well.

The Company has sent commercial agents to study packing and outlet for produce on the spot. It has got into direct communication with foreign purchasers and the French producers. It has published notices on exporting and distributed them free. At the Marseilles and other exhibitions it arranged packing competitions ; it also defrays the expenses of exhibits of the " United P. L. M. Producers " : these took 82 prizes at Turin in 1911. In Paris, in 1913, it arranged an exhibit covering 700 sq. yds. and containing 5000 dozen flowers from the Riviera. Educational journeys to London, Scotland, Belgium and Holland have been arranged for producers.

On the Paris market the Company keeps an inspector to settle small differences on the spot ; he also considers proposals for improving the service.

In 1909 it distributed in the Carpentras district thousands of plants of a strawberry much in favour in Germany ; in 1911 and 1912 Mirabelle plum trees and greengage trees were distributed, as well as plum grafts. Grapes of very late table grapes were also distributed, and in 1912 and 1913 tomato seeds from Naples. It has experts to advise as to planting, and arranged lectures, field demonstrations and agricultural journeys in France and abroad. Further a series entitled " Publications of the P. L. M. Co. " have been printed.

Lastly, freights have been lowered on its own system, as well as by through carriage to other systems and foreign railways. In this connection a prize of 100 fr. (£ 4) has been arranged for prunes leaving France by the Nord and Ouest Cos.

*Flower trade.* — The principal lines for flowers from the Riviera are

Paris.

England via Boulogne.

Germany via Petite Croix.

Belgium, Holland and Germany via Jenmont-Herbetal.

Almost all the Riviera flowers are sent in postal packages of 5 (11 lbs.) ; they are packed in flat reed baskets, which are stacked in ordinary vans.

Table III shows the extent of the traffic in the last ten years.

TABLE III. — *Flowers carried by the P. L. M. (metric tons).*

Winters	Paris	England	Germany via Petit-Croix and via Paris	Geneva and Switzer- land	Beyond Paris, various	Total
1-1904 . . . . .	2 692	2 381	1 126	115	814	7 128
1-1905 . . . . .	2 037	1 813	1 061	134	1 152	6 197
1-1906 . . . . .	2 648	2 311	1 953	173	656	7 741
1-1907 . . . . .	2 504	1 808	1 825	190	714	7 041
1-1908 . . . . .	2 757	2 168	2 629	171	731	8 456
1-1909 . . . . .	3 401	2 171	2 982	181	1 194	9 929
1-1910 . . . . .	3 338	1 872	3 272	196	1 096	9 768
1-1911 . . . . .	3 568	2 256	3 504	211	1 260	10 799
1-1912 . . . . .	3 686	2 110	3 156	198	1 217	10 367
1-1913 (1) . . . . .	3 836	2 547	3 620	232	1 348	11 583

1) From October 1912 to end of March 1913.

A collecting train arriving at Marseilles at 6.30 p.m. brings in the vans at the various stations, the most distant having started at 11 a.m. They are forwarded to Paris by two regular fast trains, one of which runs in two days from November 15 to May 1.

Flowers leaving Nice at 1 p.m. arrive:

Paris, next day at 10.30 a.m. (= 21  $\frac{1}{2}$  hrs.) in the early season, or 8 a.m.

(= 19 hrs.) in the height of the season,

Bonlogne, next day at 6.30 p.m. (= 29  $\frac{1}{2}$  hrs.).

London, second day at 4 a.m. (= 39 hrs.).

Brussels, second day at 5 a.m. (= 40 hrs.).

Frankfort-on-Main, next day at 11 p.m. (= 33 hrs.).

Cologne, second day at 7 a.m. (= 41 hrs.).

Berlin, second day at 8 a.m. (= 42 hrs.).

Although the route from the Riviera to Berlin through France is 180 miles longer than the one through Italy (Chiasso-Bale), the time is the same and the French route costs less.



## PLANT DISEASES.

### GENERAL INFORMATION.

681 — Decree of the President of the French Republic, April 18, 1914, relating to the Importation into Algeria of Plants other than Vines and Resin-yielding Trees (1). — *Journal officiel de la République Française*, Year 46, No. 113, p. Paris, April 26, 1914.

Art. 1. — Woody plants (other than vines and resin-yielding palms (rooted or not), and the fresh parts of these plants, coming from foreign countries and from the French departments of Alpes-Maritimes, Var, Bouches-du-Rhône, Gard, Hérault, Aude, Pyrénées Orientales and Corsica, may only be taken into Algeria through the ports to be designated by the Governor General of Algeria, or at the points on the Algerian-Tunisian frontier to be determined by agreement between the French Government and the Governor-General of Algeria.

On arrival at the ports or the points on the land-frontier, these plants will be disinfected in buildings prepared for the purpose and under the direction of technical experts chosen by the Governor-General. Such disinfection will be carried out by means of a mixture containing gaseous hydrocyanic acid, the strength of which will be determined by the said technical agents.

The operation will be carried out at the expense of the interested parties. Exceptionally, when the consignments are accompanied by a phytopathological certificate granted by the Service of Phytopathological Inspection and are sent from establishments under State control, they will be exempted from disinfection, provided their freedom from parasites is ascertained by the technical agents mentioned.

In case they are not passed, the importer may decide whether they are to be disinfected under the conditions laid down above or return them to their place of origin.

Art. 2. — Citrus fruits imported into Algeria will be disinfected under the conditions laid down in art. 1 for woody plants.

(1) See also No. 2026, *B.* June 1911 and No. 1347, *B.* Sept. 1912.

Art. 3. — Infringements of the regulations of the present decree of the orders made for carrying it out will be punished by a fine of 500 fr. (£2 to £20).

Art. 4. — Persons convicted of having introduced any of the objects mentioned in arts. 1 and 2 without declaration or by means of a false declaration or by any other fraudulent device, will be punished by imprisonment for from 1 month to 15 months and by a fine of from 50 to 500 fr.

Art. 5. — The punishments laid down in the two preceding articles be doubled for a second offence. A second offence is established when a judgment under this decree has been given against the offender in previous twelve months.

Art. 6. — Article 463 of the Penal Code is applicable to convictions under the present decree.

Art. 7. — Woody and herbaceous plants coming from France will be admitted into Algeria, with the earth surrounding them, provided they have been raised in pots at establishments listed by the Ministry of Agriculture under article 9, § 6, of the International Convention of Berne. For plants coming from foreign countries, this condition will be replaced by an obligation, on the part of the interested parties, to obtain a permit, issued by the Governor-General of Algeria previous to the despatching of the goods, and after seeing a special declaration signed by the French consular authority of the place of origin.

All the regulations of the decree of March 10, 1894, not contrary to the present decree, are maintained.

Art. 8. — The decrees of January 25 and November 22, 1909, are abrogated.

Art. 9. — The Minister for the Interior, the Minister of Finance and the Minister of Agriculture are entrusted, within their respective powers, with the carrying out of the present decree, which will be published in the *Journal Officiel* of the French Republic and inserted in the *Bulletin Officiel* of the Government of Algeria.

**Act allotting 500 000 Francs to the Minister of Agriculture of France for the Control of Voles (1).** — *Journal Officiel de la République Française*, Year 46, No. 116, p. 3854. Paris, April 29, 1914.

The President of the French Republic has promulgated an Act, dated April 23, 1914, of which the following is the purport:

Article 1. — A sum amounting to 500 000 francs is granted, from the 1914 budget, in addition to the provisional grants allocated by the Acts of November 29, 1913 and February 26, 1914. The sum will be inserted in a special article of the Ministry of Agriculture, bearing the No. 27 bis, and entitled "Grants to Communes, Syndicates and Agricultural Associations for the Destruction of Voles. Expenses of Organization of Control Measures." The present Act, discussed and passed by the Senate and by the Chamber of Deputies, will be in force as the law of the Land.

(1) See also No. 385, B, April 1914.

# DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

683 - **Leaf-Curl in Potatoes and its Connection with Necrosis of the Phloem**  
SCHANDER, R. and TIESSENHAUSEN, M. in *Mitteilungen des Kaiser Wilhelms Institut  
Landwirtschaft in Bromberg*, Vol. IV, Part 2, pp. 115-124. Berlin, 1914.

The writers wished to control the investigations of Quanjer (1907) which led him to believe that leaf-curl of potatoes (*Blattröllkrankheit*) was due to necrosis of the phloem. Among the material examined, some of the same as was used by Quanjer.

It was ascertained that : 1) Necrosis may appear in plants not affected by leaf-curl (either in quite sound plants or in plants attacked by "Krankheit", etc.), and sometimes in a much worse form than in those affected by leaf-curl.

2) Such necrosis usually begins towards the apex of the stem, doubt owing to the fact that the young tissues are more sensitive to assimilatory disturbances than the old ones. Further, it is more prevalent towards autumn in nearly all plants.

3) The phloem of the potato seems to be specially susceptible to this alteration, while in the tomato, which often suffers from strong leaf-curl, no important necrosis of the phloem has been observed. The phloem of the potato seems so susceptible that it may become necrotic without the plant appearing abnormal or losing its vigour.

4) General necrosis seems to be infrequent : the disease is generally limited to a portion of the phloem, so that complete interruption of descending sap is very rare.

5) Lignification of the necrosed phloem has never been observed.

The writers believe this condition to be a secondary one, appearing in consequence of functional disturbances taking place in the leaves.

684 - **Observations on Bramble-leaf of Vines in Hungary** (1). — BERNATSKY in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 3, pp. 129-139, figs. Stuttgart, 1914.

From observations in the vine districts of Hungary, the writer ascertained the following facts with regard to the bramble-leaf disease (*Krautern des Weinstockes*).

1. It attacks old American stocks only on low ground, particularly in depressions and valley-bottoms, on damp, rich and heavy soil. A depth of a few feet may quite prevent the appearance of the disease in such cases.

2. Young vines, one or two years old, may be attacked in situations unfavourable as regards height and soil.

(1) For previous work on this disease see the following Nos.: 1911-1914 (1911-1914), 1883 (June); 1912-1914 (March), 968 and 969 (June), 1097 (July), 1349 and 1350 (1915) (Nov.); 1913-1914 (Jan.), 1207 (Oct.), 1302 and 1303 (Nov.), 1394 (Dec.); 1914 (March), 480 (May), 576 (June).

3. In many rather old vines examined (hybrids of *Ripestris*, *Ruparia* *Berlandieri*) it was found that the swollen part at the top was dead; dead tissue generally extended from the pith to the origin of the shoots. There, there are streaks of brown wood reaching a good way down the stem, as often happens after frost damage.

4. The wood and bark of diseased vines, whether living or dead, very incompletely differentiated, or in other words does not ripen well.

5. It is interesting to note that diseased plants often come from grafts poorly ripened wood; this is often the case in quite young vines in favourable situations, but yet diseased. For this reason, the writer considers the practice of using the ends or side shoots of the canes for grafts as sound, for these parts are nearly always badly ripened.

6. The roots of vines affected by bramble-leaf were diseased, and sometimes even rotten. The writer considers this not as a result, but the cause of the disease, and due to certain soil conditions.

7. In grafted vines (*Vinifera* on American stocks) the cause of the diseased condition is often to be found in an imperfect binding; this is particularly liable to occur with woody grafts on unrooted stocks. In warm soils, with other conditions favourable, a complete closing of tissues takes place later, but if the weather is unfavourable or the soil suitable (cool and damp), the wound tends to open wider instead of closing. Eventually it forms a cankerous growth, and the wood at the point of union is soft and hypertrophied, and finally dies. This disturbance of the relations between graft and stock shows itself later in the evolution of the bramble-leaf condition.

8. Even when the binding is perfect, the disease may appear. It is suggested that this may be due to damaging of the graft (*e. g.* by frost).

9. In grafted vines affected by the disease, the stock often throws suckers, which also become diseased.

10. In making herbaceous grafts, the suckers are often not removed when the vine is planted out; they then leave open wounds, which may, under unfavourable conditions, spread and become cankerous, thus encouraging disease in the plant.

11. Parasites have sometimes been found to cause the disease, but when present on the roots; of these cockchafer grubs (*Melolontha* *varis*) are the most important, though *Phylloxera* may sometimes produce it.

It thus appears that the cause of bramble-leaf is to be sought in conditions which act only indirectly on the canes, the trouble being deep-seated or the result of causes which have disturbed the whole plant.

## BACTERIAL AND FUNGOID DISEASES.

- 685 - **On the Presence of Sori and Mycelium of Rusts in the Caryopses of Cereals.** — ERIKSSON, JACOB in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1914, 1st Half-year, Vol. 158, No. 17 (April 27, 1914), pp. 1194-1200, Paris, 1914.

Referring to Beauverie's observations (1) on the presence of the sori and mycelium of rusts in the caryopses of cereals and other Gramineae the writer remarks that he had already described and figured this in 1886. In 1901 he expressed the opinion that the presence of the sori and mycelium is to be considered as an abnormal and excessive growth, without practical importance in the life of the fungus. After the publication of F. J. Pritchard of similar observations in the United States, Eriksson made known in 1912 his own results on the wintering of cereal rusts. Results obtained since have confirmed the opinion that the presence of mycelium and clusters of spores on the surface of the caryopses is without importance.

- 686 - **Resistance of Hybrid Direct-Bearer Vines to Mildew.** — PÉE-LARY, E. in *La Vie agricole et rurale*, Year 3, No. 22, pp. 603-605. Paris, 1914.

One of the most important properties of hybrid direct-bearers is their resistance to mildew (*Plasmopara viticola*). The following among the older hybrid vines have been thoroughly tested in this respect in various parts of France: Seibel Nos. 1, 2, 63, 110, 138, 1000, 1007, 1014, 1015, 1017, 1077, 2003, 2007 and 2041; Couderc Nos. 503, 4401, 7103, 7120, 281 and 106-48. All these can do without copper-sulphate spraying in moderate mildew years. The following should under ordinary circumstances be sprayed twice: Seibel Nos. 47, 60, 128, 1020, 1200, 2042 and 2044.

Various newer hybrids appear to require only two sprayings, but have not yet been sufficiently tested; many of these yield better wines than the older ones, so that it is to be hoped that their mildew resistance will be confirmed. The following white hybrids may be recommended: Gire No. 157; Seibel Nos. 880 (which might do without spraying), 793, 82791, 3010, 3021 and 4681; several Malègue types, several Couderc and two Bertille-Seyve.

Two new rose-coloured direct-bearers (Seibel Nos. 2859 and 2610) also appear to be sufficiently protected by two sprayings.

- 687 - **Wilt Disease of Sweet Potato.** — HARTER, L. L. and FIELD, ETHEL C. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, Part 4, pp. 204-207. Stuttgart, 1914.

The wilt disease of sweet potatoes is characterized by the wilting of the whole plant or parts of it; the diseased portions become discoloured and die; no wrinkling of the leaves takes place in such cases. The agents or agents of the disease occur in the vascular bundles of roots, stem and leaves.

(1) See No. 879, B. July 1913 and No. 73, B. Jan. 1914.

*Nectria Ipomoeae* Hals. has generally been considered the cause of the disease, but a series of inoculations (1500) with various species of *Fusarium* isolated from the xylem of roots and stems and from tubers wholly or partly decayed, have shown that *F. hyperoxysporum* Wr. (isolated from the xylem of the stem) and *F. Batatas* Wr. (from the vascular bundles of the root) both parasites capable of producing the symptoms of wilt disease. Inoculations of *Ipomoea Batatas* Poir. with *F. hyperoxysporum* produced 100 per cent. of infections, while with *F. Batatas* 45 per cent. became diseased. The cultures of the latter were obtained from various parts of the United States (Maryland, New Jersey, Virginia and Delaware).

Inoculations with both species of *Fusarium* were tried on other plants: *Conium maculatum* L., *S. Melongena*, *Lycopersicum esculentum* Mill., *Ipomoea purpurea* Roth., *I. hederacea* Jacq., *I. coccinea* L., and *I. lacunosa* L. Only with *I. hederacea*, which grows wild in sweet-potato fields, were positive results obtained; both species gave infection. It is probable that the disease is spread by means of this weed.

Inoculations with *Nectria Ipomoeae* were entirely without result, so that this fungus appears not to be the cause of the disease. It appears that various species of *Fusarium*, in particular *F. oxysporum* Schlecht., *F. dimorpha* W. Smith, *F. orthoceras* App. et Wr. and *F. caudatum* Wr., are about the rotting of stored sweet potatoes.

**Black Spots on Tomatoes caused by *Cladosporium herbarum*.** — EROTTI, R. and CRISTOFOLETTI, U. in *Le Stazioni sperimentali agrarie italiane*, vol. XLVII, Part 3, pp. 169-216, figs. 1-6, plates IX-XI. Modena, 1914.

Tomatoes of a variety with fruits in clusters have frequently been infected late in the season with olive-black spots on them; these are irregularly circular, and gradually increase in size: they are due to *Cladosporium herbarum*.

On naturally-occurring spots a bacterium has always been found with *Cladosporium*: this is described as new under the name of *Pseudomonas promigena*. An undescribed form of *Oospora* (*Oidium*) *lactis*, var. *tomato*, is also frequently present.

The writers have investigated the morphology, physiology and pathogenic character of the *Cladosporium* and the *Pseudomonas*, as well as the action of the *Oospora* and the *Pseudomonas* on the *Cladosporium* in the spots on the fruits.

The *Pseudomonas* is in no way parasitic, its development being permitted by the reduction of the acidity of the sap due to the attack of *Cladosporium*.

The *Oospora* is a true parasite of the tomato fruit, but takes no direct part in the formation of the spots. The *Pseudomonas* and the *Oospora* tend to hinder the development of the *Cladosporium*, restricting and slowing the rapidity of its attack on the fruit.

The *Cladosporium* seems to infect the fruit through small breaks in the skin.

The proportion of fruit attacked in the variety in question is between 70 per cent. At present the disease does not seem serious, but

should it become so, the best course to pursue would be to grow varieties resisting it.

689 - **The Anatomical and Physiological Conditions of Chestnut Branches attacked by the Ink Disease.** — PETRI, I., in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXIII, Series 5, 1st May year, No. 5, pp. 363-369. Rome, 1914.

The writer has already expressed the opinion that *Coryneum medullarium* Griff. et Maubl. (which he considers identical with *C. perniciosum* Briosi et Farneti) should be regarded as one of the agents in the rapid withering of the branches of chestnuts attacked by ink disease (a black rot of the roots and the stool), and not as a cause of the disease.

In 1913 investigations were made on the physiological condition of the twigs in trees attacked by the disease.

Branches three to nine years old were collected from diseased and healthy trees in the chestnut-woods of Soriano nel Cimino (Latium) at the end of November 1913, when the trees had just lost their leaves. Various differences were found, chiefly by micro- and macrochemical means between the branches from healthy and from diseased trees. The decreased content of certain minerals, such as lime, sulphur and potash, and the increased content of magnesia, are evidences of a diseased condition, due doubt to disturbances in the functioning of the root-system. It is in the mineral food that the earliest and most serious irregularity takes place. The destruction of chlorophyll and the disorganization of the chloroplasts of the cortical parenchyma should be considered as the natural consequences of assimilatory disturbances and reduced vitality of the protoplasm closely connected with the high acidity, absence or reduction of calcium oxalate, and increase of gallic acid.

These conditions no doubt allow the twigs to be attacked by parasites some time before any diseased condition is visible.

## INSECT PESTS.

690 - **Insects Injurious to Crops in the Nyasaland Protectorate.** — BALLARD, in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 347-351. London, 1914.

The following insects have been collected on or bred from cultivated plants in 1911 to 1913; unless otherwise stated they are from the Upper Shire district.

ORTHOPTERA. — *Acridiidae*. — *Maura bolivari* Kirby and *Chrotogaster* sp. are very destructive to seedling tobacco. The following also damage tobacco to some extent: *Acrida turrita* L. (Lower Shire), *Zonocerus elegans* Thunb., *Catantops opulentus* Karsch, *C. solitarius* Karsch, *C. viridis* Sauss., *C. melanostictus* Schaum, *Morphacris fasciatus* Thunb., *Oedipoda citrinus* Sauss., *Gastrimargus marmoratus* Thunb., *G. wahlbergi* Stål, *Myrmica patruelis* H. S., *Oxyrrhypes procera* Burm. and *Acridium lineatum* Gryllidae. — *Brachytrypes membranaceus* sometimes damages crops by eating the roots.

LEPIDOPTERA. — *Noctuidæ*. — The red bollworm (*Diparopsis castanea* (p.)) is very injurious to cotton throughout the Protectorate; *Chloridea sleta* F. occurs everywhere with it, and besides destroying the bolls and stems of cotton, attacks maize, tobacco capsules and chick-peas. *Earias dana* is not as bad a pest of cotton as the previous two, possibly owing to its being severely parasitized by an Ichneumonid: it is generally distributed throughout the Protectorate and has been found on *Hibiscus*. *Boa segetum* Schiff. gnaws the stems of tobacco in January and February. *denia litura* F. is worst in the tobacco seed-beds, but it also damages tobacco after planting out, and has been found on cotton and maize, and once on tea. The larvae of *Plusia orichalcea* F., *P. chalcites*, *Cosmoea erosa* H. B., *Gonitis sabulifera* Guén. and *Acontia graellsii* Feisth. are more or less injurious to cotton, eating the leaves up to the time of flowering; on the Upper Shire they are about from December to the middle of March. *Busseola fusca* is one of the worst pests in the Protectorate, getting into the stalks of maize and millet. *Pteronycta fasciata* Hmp. (fully described) is uncommon, but would be very injurious if it were to increase in numbers, as the larva bores into cotton stems to pupate; the test wind is enough to break one of the bored stems, so that the plant dies.

*Limacodidae*. — *Parasa vivida* Walk. occasionally appears on coffee, and does considerable damage.

*Lymantriidae*. — *Heteronygmia leucogyna* Hmp. is common on mahogany (*zya senegalensis*); plantations near Somba have been almost completely defoliated by it.

*Pyalidae*. — The cotton leaf-rolling caterpillar (*Sylepta derogata* F.) is common on cotton in the Upper Shire, at any rate about Somba; further north, on the banks of Lake Nyasa, it is much more frequent and injurious. The larvae are largely parasitized by a Chalcidid.

*Tineidae*. — *Phthorimaea heliopa* Lower bores into the stems of young tobacco plants, and is most injurious in the seed-beds. *Gracilaria* (sp.) is common, but not much to be feared; the larvae mine cotton leaves, but seem to have little effect on vigorous plants.

*Nymphalidae*. — *Hypolimnas misippus* L. was once found in a cotton plantation, some plants being defoliated by considerable numbers of the larvae.

COLEOPTERA. — *Lagriidae*. — *Lagria villosa* F. devours the flowers and leaves of pulse crops.

*Galerucidae*. — *Ootheca mutabilis* Sahl. occurs on cotton, Leguminosae and Cucurbitaceae, being especially destructive to the flowers of native plants. *Diacantha conifera* Fairm. attacks Cucurbitaceae and Leguminosae. The imago of *Asbecesta cyanipennis* Har. eats the leaves of Leguminosae, and is not very harmful. *Pachytoma gigantea* was found damaging the leaders of young cypresses in plantations at Mlanje, on the top of Mount Somba.

*Tenebrionidae*. — *Zophosis* sp. (adult) is sometimes injurious to cotton seed-beds, while *Gonocephalum simplex* F. does a little damage in tobacco plantations.

*Dermestidae*. — *Dermestes vulpinus* F. is common in houses.



*Meloidæ*. — *Mylabris tricolor* Gerst., *M. amplexans* Gerst., *M. dicine* Bert. and *Decaloma catenata* Gerst. destroy cotton flowers, while *Ceroctis trifurca* Gerst. eats the flowers of soy beans and velvet beans (*Mucuna pruriens* var. *edulis*).

*Curculionidæ*. — The larvæ of *Apion armipes* Wagn. bore into cotton stems; a swelling is produced at the injured part, and the stem may break in a strong wind; the insect is capable of doing considerable damage and appears to be generally common in the Upper Shiré. *Calandra oryzae* is very injurious to stored maize and rice. A species of *Isaniris* is common; the adult eats cotton leaves, but does not do much harm.

*Coccinellidæ*. — *Epilachna dregei* Muls., *E. hirta* Thunb. and *E. fabae* Muls. are harmful in gardens. *Chilomenes lunata* F. is very useful in destroying *Aphis gossypii*.

*Cassididæ*. — *Cassida gibbipennis* is somewhat injurious to Leguminosae.

*Nitidulidæ*. — *Epuraea* sp. eats the stamens of cotton flowers, but of little importance.

*Ptinidæ*. — *Lasioderma serricorne* F. tunnels into cigars and cigarettes.

HYMENOPTERA. — *Tenthredinidæ*. — *Athalia* sp. is very injurious to turnips and cabbages.

RHYNCHOTA. — *Aphididæ*. — The cotton aphid (*Aphis gossypii* Glover) is very harmful in some seasons, especially those with heavy rainfall. *Aphis brassicae* L. is abundant on cabbages and difficult to destroy with wash owing to its waxy covering. Another species damages beans. *Aphis lataniae* Newst. has occurred on *Raphia vinifera* in the Botanic Garden at Somba.

*Coccidæ*. — *Pulvinaria jacksoni* Newst. has been noted in small numbers on cotton.

*Coreidæ*. — *Anoplocnemis curvipes* F. does some damage to cotton by sucking the sap; it has also been observed puncturing young shoots of mahogany.

*Pentatomidæ*. — *Antestia variegata* Thunb. damages coffee berries while *Atelocera stricta* Westw. sucks the young shoots of mahogany.

*Pyrrhocoridae*. — The cotton stainer (*Dysdercus nigrofasciatus* Stål) occurs throughout the Protectorate and is very injurious; *Odontheolus confusus* Dist. has the same habits, but is restricted to the lower and better parts.

#### 691 — Contribution to the Biology of *Bibio hortulanus*, and its Control.

MOLZ, E. and PIETSCH, W. in *Zeitschrift für wissenschaftliche Insektenbiologie*, Vol. 1914, Parts 3 and 4, pp. 98-105 and 121-125. Berlin-Schöneberg, 1914.

*Bibio hortulanus* appeared in the Province of Saxony (Prussia) in quite epidemic form in 1913; previously it had only been known to injure beet but in this season it attacked spring crops of barley and wheat so severely that many fields had to be ploughed up and resown.

The damage is due to the larvae, which go on feeding up till the beginning of May, when they pupate at 2 to 4 in. below the surface of the soil.

The writers have carried out a long series of laboratory experiments with chemicals and other means for the destruction of the larvae, as well as observations on the life-history with a view to finding a point of attack. Spraying of the seed gave no results, and contact poisons (sulphate of iron, and soap) had very little effect on the larvae.

The following measures seem to give good results :

1) In cases of severe damage in spring, the land should be ploughed early at the time of pupation (which begins in early May) and then well ledd; in this way a large number of the insects are prevented from reaching the surface, while those which do so will be much weakened. If it is necessary to plough earlier in preparation for another crop (say the middle of April), thorough harrowing should follow, so as to injure the larvae; in case little damage is likely to be done to the second crop, though a number of insects will emerge.

2) The best means of destroying the adults is to place wisps of straw sticks about a yard high, in the places where the larvae have been noted, at the time of emergence of the gnats: this begins about the 20th day, only isolated individuals being observed as early as the 10th. The gnats settle by preference on these wisps, and can be collected and killed cool mornings: several hundred may be found on a single wisp.

3) Care should be taken that no dung, particularly stable dung, is left about at the time of emergence of the gnats; farmers believe that the gnats are spread by means of stable dung.

The abundance of these gnats in the Saxon province is very likely connected with the prevalence of beet aphids (*Aphis papaveris*) in 1911 and 1912, as the honeydew produced by them is very attractive to the gnats.

- **Anagrus ovijentatus, a Hymenopterous Parasite of the Eggs of *Lygus pratensis*.** (1) — CROSBY, C. R. and LEONARD, M. D. in *The Canadian Entomologist*, Vol. XLVI, No. 5, pp. 181-182, figs. 19-20. London, 1914.

From an egg of *Lygus pratensis* on *Erigeron ramosus*, obtained at Ithaca (New York) in October 1913, a Hymenopterous parasite was reared; others were also obtained by enclosing heads of the plant in breeding-cages. It appears to be a new species, and is described under the name of *Anagrus ovijentatus*; it is near *A. saga* Girault, but differs from this in several particulars.

- **A Nematode Parasite of the Olive Weevil (*Rhynchites ruber*).** — DEL GUERCIO, G. in *Redia, Giornale di Entomologia*, Vol. IX, Part. 2, pp. 233-234. Florence, 1914.

The great irregularity in the appearance of the olive weevil (*Rhynchites ruber* Fairm.) (2) and in the amount of damage it does is very likely due in part to the presence of a so far unrecorded parasite: this is a minute Nematode worm, apparently a *Rhabditis*, which the writer has noticed since 1911. The worms attack the larvae when they leave the olives and burrow into

(1) See also No. 1387, B. Sent. 1912.

(2) See No. 1240, B. Aug. 1912.

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the ground. Once inside the larva, the worm grows and reproduces, so that the host becomes a centre of infection for other larvae. The infected larva eventually becomes motionless and dies. After death the body becomes covered with a whitish felt, consisting of numbers of the Nematodes; they are very prolific, so that the number hatching from the eggs is enormous.

- 694 - **Control of the Second Generation of Vine Moths by means of Protecting Envelopes.** — MILANI, A. in *Zeitschrift für Pflanzenkrankheiten*, Vol. XXIV, (Paris), pp. 139-148. Stuttgart, 1914.

The writer has made trials of the protecting envelopes (German patent No. 250 053, July 1, 1911) for use against the second generation of the vine moths (*Conchylis ambiguella* and *Polychrosis botrana*); these were carried out in the three seasons 1911-1913, in conjunction with the Vine-growing College at Geisenheim (Germany). The envelopes in question are closed and open below, and the opening is gummed; they are put over the flower clusters in June, and the moths coming to lay are caught by the gum.

It has been found that grapes so protected were hardly damaged at all, while the unprotected ones were sometimes severely damaged.

- 695 - ***Lachnodius greeni*, a New Scale Injurious to Coffee in Madagascar.** — VAYSSIÈRE, P. — *Bulletin de la Société entomologique de France*, 1914, No. 5, pp. 190-191. Paris, 1914. — *Journal d'Agriculture tropicale*, Year 14, No. 154, p. 125. Paris, 1914.

The writer describes under the name of *Lachnodius greeni* a new and insect sent to the Paris Entomological Station by M. Fauchère, inspector of colonial agriculture in Madagascar. This species occurs in clusters on the roots and stems of coffee, covered over by cells of earth and bark made by ants. It appears to be a serious pest of *Coffea robusta* and *C. liberica*.

Treatment should if possible be carried out before the scales are covered up by the ants. The bottom of the stem and the parts of the main stem attacked should be laid bare and then washed with a petroleum insecticide strong enough to destroy the insects without damaging the plants. Proper attention to the plants will also help them to resist the scale and its enemies.

- 696 - **The Yellow-headed Coffee Borer (*Dirphya princeps*) in Uganda.** — GOWDEY, C. C. in *Bulletin of Entomological Research*, Vol. IV, Part 4, pp. 278-282, 2 figs. London, 1914.

*Dirphya (Nilocris) princeps* Jord. (Cerambycidae) was first recognized in Uganda as injurious to *Coffea robusta* in 1910; it has since been found on *C. arabica* also.

The bushes attacked can readily be recognized by the accumulation of excreta and gnawed wood below them. The branch through which the larva has made its way into the main stem can generally also be recognized either by the openings of the horizontal tunnels in it or by its tip having turned black: the latter occurrence is, however, not to be relied upon.

If the larva is still in the side branch, the simplest way to destroy it is to cut off the branch and burn it. If it has gone into the main stem the best thing is to inject a few drops of carbon disulphide or carbon tetrachloride into the gallery; the side branch through which it has entered should

cut off close to the stem, so that the opening can be used for the injection; and all other openings should then be closed with damp clay.

If the larvae are not killed, the tree soon dies or else gets broken by wind. Coffee bushes less than two years old do not seem to be attacked.

— ***Pseudococcus filamentosus*, a Scale injurious to Tropical Trees.** — FAYSSERRE, P. in *Journal d'Agriculture tropicale*, Year 14, No. 154, pp. 109-111. Paris, 1914.

*Pseudococcus filamentosus* Ckll. (= *Dactylopius perniciosus*) was first recorded about twenty years ago in Hawaii; it has since spread to various parts of the world.

In 1899 it occurred in Mauritius on Euphorbiaceae and citrus fruits; it was reported from Jamaica. In 1906 it was found in Cairo on cotton *Albizia Lebbeck*, and by 1909 it had become a serious pest of the *Albizia* along the avenues of the city. In 1912 the writer recorded it in French Africa (Koulikoro, Upper Senegal-Niger) on *Ximenia americana*. In German East Africa was stated to be the original home of this scale; it is observed there on native cotton in 1909, and in 1911 was found to be highly injurious to ornamental trees in Daressalam.

A tree infested by this insect has its branches and leaves covered by masses of white filamentous waxy matter, which sometimes form sheets hanging one branch to another. Among these masses can be found adult scales, eggs and larvae. The recently-hatched larvae migrate in quantities to the young branches and leaves; thence they are easily carried by the wind, birds or insects to considerable distances.

Severely attacked trees may be killed in a few months. Infection always begins at the top; first the leaves turn brown and fall off, then the branches also wither and die. Hundreds of trees were killed in Egypt in Cairo, and also in Honolulu at the time of the outbreak in Hawaii (1891).

Until lately the number of host-plants known was limited, but at Daressalam it has attacked a great variety of trees. The most favoured are the following: *Albizia Lebbeck*, *Pongamia glabra*, *Pithecolobium Saman*, *Andron anfractuosum*, *Citrus*, *Acacia arabica* and *Loranthus*; the latter, a parasite of various trees, tends to weaken them and make them more susceptible to the scale. At the same time, the *Terminalia* trees at Daressalam, though parasitized by species of *Loranthus*, were hardly affected.

Other trees resistant to this scale are: the species of *Eucalyptus*, *Plumeria*, *Bauhinia* and *Bougainvillea*, as well as *Pithecolobium Syzygium guineense*, *Barringtonia racemosa*, *Anacardium occidentale*, and species of *Sterculia*, etc. Occasional hosts are: *Sapindus Saponaria*, *Opiphyllum Cainito*, *Landolphia* sp., various species of *Ficus* and *Bambusa Khaya senegalensis*, cottons, palms, *Melia Azedarach*, various species of *Albizia*, *Ximenia americana*, etc. *Mangifera indica*, which was badly attacked at Daressalam in 1912, should also be classed here.

Among natural enemies so far known should be mentioned two Chalcidids (Hymenoptera), as internal parasites in Egypt, a predatory Hemipterid

larva (Neuroptera) in Cairo, and three Coccinellids: *Exochomus nigron* *culatus*, *Scymnus includens* and *Cryptolaemus montrouzieri*. The latter named ladybird, coming from the Cape, was found very efficient against this scale in Hawaii, and should be acclimatized in various parts of Africa to keep scales in check.

In new centres of infection cultural methods and insecticides should be given preference over introduction of natural enemies. In particular resistant species of trees should be chosen for parks and avenues, and infested trees of no economic value should be destroyed; *Loranthus* should be removed. The best insecticide seems to be petroleum emulsion (15 per cent.) applied as a winter wash; mixtures of petroleum, soap and lime are also good.

